FEBRUARY 1961

SPECIAL REPORT ON RESEARCH

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. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings

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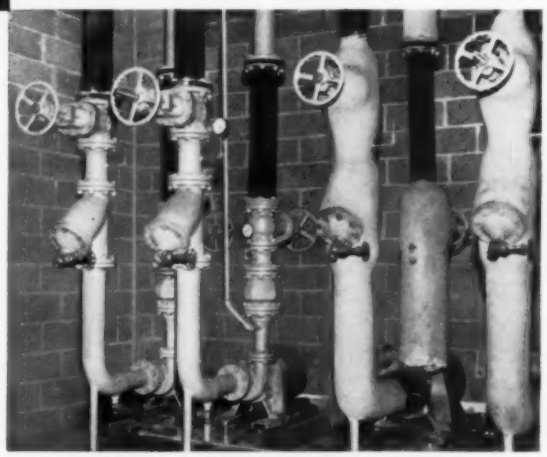

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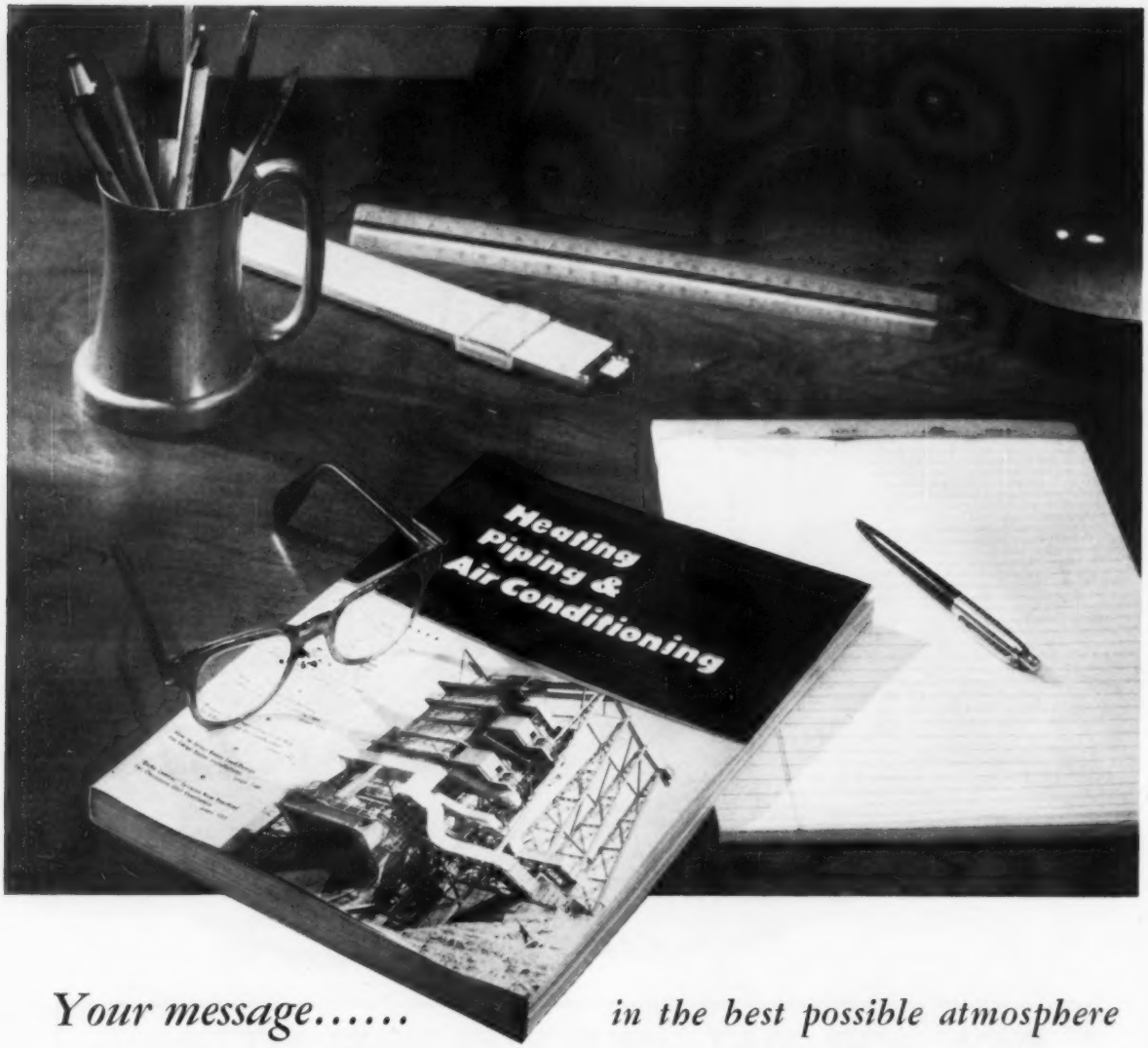

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How *Imaginative Engineering* Put Taming Chicago's

John Dolio (right) in front of Powers Graph-O-Matic Control Panel with E. S. Anderson, engineer for the Illinois Psychiatric Institute.

The unusual temperature requirements specified for the new Illinois Psychiatric Institute presented an extraordinary challenge for John Dolio & Associates. This Chicago engineering firm was asked to provide an absolutely uniform temperature throughout the 11-story, T-shaped building. Because temperature variations cause extreme discomfort —even pain—to mental patients, the system had to be accurate, foolproof and automatic. Because Chicago temperatures rise or fall to extremes within hours—sometimes minutes —the system had to be capable of sensing the changing weather picture outside and automatically and simultaneously reacting inside.

The resulting design provides all the answers . . . in a Powers pneumatic control system that operates automatically 24 hours a day—every day—at a bare minimum of cost; a system that compensates instantly for sudden outdoor temperature changes; a system that can be checked and controlled by one man.

The result is a functional system of control where practical engineering principles were combined by the Dolio firm with a strong helping of ingenuity in order to whip some of the more unusual problems. For example, since chilled water was to circulate through ceiling heating-cooling panels, a safeguard against condensation was necessary. The engineers solved this problem with a series of dew point controls mounted at various locations in the ceilings. Thus, "controls on a control" prevent water temperature from falling to the point at which condensation could occur.

Phil Derrig, Chief Mechanical Engineer of the Dolio firm, inspects one of the dew point controls specially designed to prevent condensation of cold water in the ceiling heating-cooling panels.

Powers Temperature Control To Work Weather At Illinois Psychiatric Institute

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Chicago, Ill.

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Louis H. Gerding

Architects:
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Associate Architects and Engineers:
Fugard, Burt, Wilkinson and Orth

Consulting Engineers:
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Heating, Air Conditioning Contractor:
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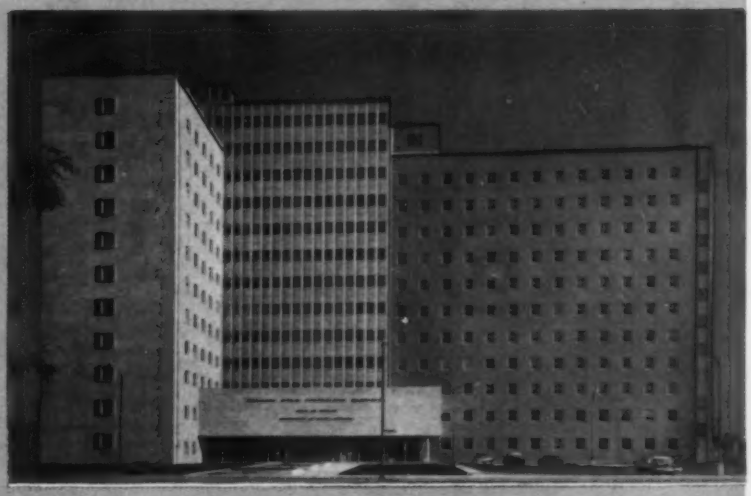

JOB DETAILS

The system encompasses 12 temperature zones, each designed to operate independently in relation to individual zone exposure problems. Ten zones utilize ceiling heating and cooling panels at which hot and chilled water circulate from zone exchangers. Three-way control valves for the water are modulated by pneumatic thermostats in various rooms. Two zones — auditorium and stairwell — have only heat exchangers (the auditorium is supplied with individual conditioned air).

Master outdoor controls sense the changes in temperature outdoors and instantly reset submaster pneumatic thermostats at the zone exchangers. These indoor-outdoor controls are engineered for foolproof maintenance of uniform zone temperatures.

A central control board, the heart of the Dolio design, monitors the complete heating, cooling and ventilating system. The building engineer alone can instantly check 170 control points by merely referring to the Powers Graph-O-Matic Control Panel.

Temperature controls are inaccessible to patients. All controls in the corridors are wall-mounted and cabinet-enclosed; temperature sensors are mounted in ceiling exhaust ducts.

Easy servicing and low maintenance are two big reasons why a pneumatic system of control was specified by this engineering firm. Efficiency at low cost is characteristic of this type of control — as it is with the Powers pneumatic system installed here.

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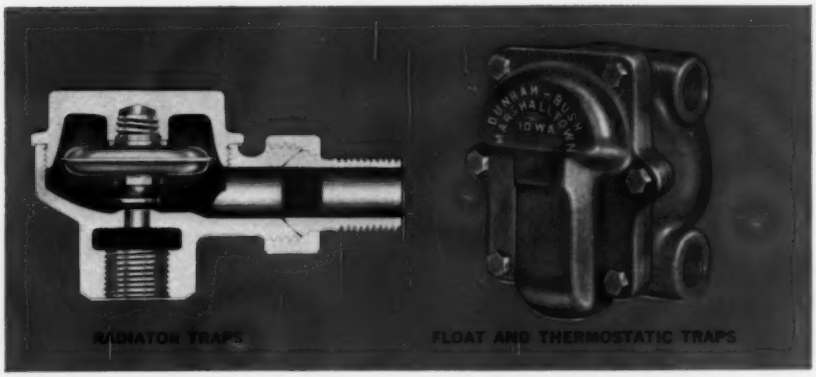

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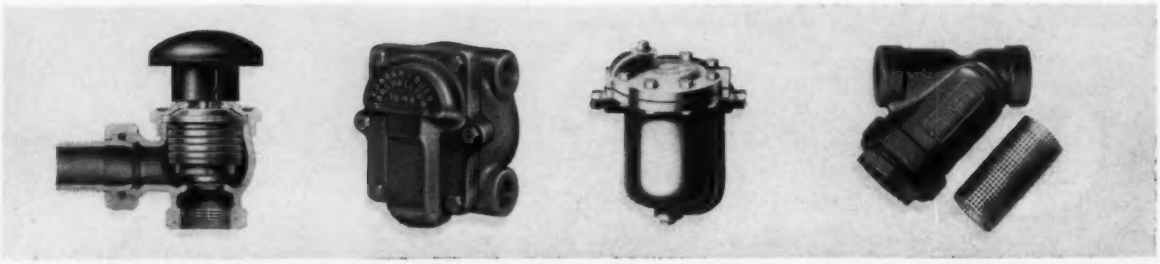

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LETTER FROM THE EDITOR

February 1961

Dear Reader:

How the heating and air conditioning systems were designed and installed in the new Exposition Center in Chicago is related by Philip M. Derrig and Lyman R. Flook in their article on pages 95 through 99. This new $35 million exposition center has been named McCormick Place, and it is completely air conditioned. With a 5000 seat theater at the south end and the main exhibition area consisting of 320,000 sq ft, many special considerations had to be included in the design of these systems as explained by the authors. Because separate areas on this level might be used for different exhibits, zoning was needed for proper environment control. To accomplish this, 22 separate air handling units and connected duct systems are installed above the trusses. Each air handling unit is equipped with its own air filtering system. Some of the air is recirculated through activated carbon filters which permits a large reduction in the quantity of outside air required. This provision was one of the changes permitted in the new Chicago Ventilation Code. Since the large building is on the shore of Lake Michigan, about 6750 gpm of condenser cooling water is delivered through a 36 in. intake pipe for the 3750 ton capacity centrifugal water chillers installed. Four 600 hp packaged horizontal fire-tube boilers provide the necessary steam to the remote converters and to the heating coils. The size and scope of this installation is certainly worthy of your attention.

A trap maintenance program that has been working most effectively in a large office building is explained by E. H. Bradbury in his article on pages 100 and 101. He reports an annual saving of 18 to 20 percent in steam consumption which has resulted through this regular testing of the 271 traps in the building at least once each year. A steam trap test stand is used consisting of trap bodies of each type in use to save time by preventing the need for changing trap bodies for different cover sizes. All traps are tested at design pressures and replacement parts are installed when operating parts do not perform properly.

A new light industry plant in New Jersey containing 72,000 sq ft of floor area is 90 percent air conditioned and is shown in the article on page 102. Several interesting features have been incorporated in this installation including provisions for controlling low relative humidities in one particular room.

Designing piping systems for high pressure and high temperature steam services requires careful evaluation of present day materials and their correct applications, pressure-temperature relationships, and other factors such as current codes and standards, etc. Henry de Soto outlines these design considerations in his article on page 105 and includes examples from the Philadelphia Electric Company Eddystone Station steam piping installation in which pressures up to 5000 psi and temperatures up to 1200 F are experienced.

A new data sheet chart is on pages 111 and 112 which aids in computing the air flow rates required to control dust and the contamination of surrounding air from filling bags, barrels, etc. Clyde F. Metzler is the author.

LETTER FROM THE EDITOR (continued) --

Coal proved to be the most economical fuel for the new heating plant which serves the Northwestern University downtown campus in Chicago. The article on page 113 explains the design details and how it was decided to use coal as the fuel. Also included in the article is a discussion of the methods used for preventing noise and air pollution nuisances. All fueling, combustion, and ash disposal operations are conducted within a single dust-tight building. The plant has an annual capacity of 260 million lb of steam.

Sam Lewis says, "Draft head is important for all thermally circulating convectors" in his article this month on page 117. This is another report of his practical experiences on a subject in which all of us should be aware.

A simplified method for rating the sound output of air distribution equipment is proposed by J. W. Spradling in his article on page 118. The author suggests that this meaningful method be accepted by engineers to aid in the selection of proper air distribution equipment from the noise standpoint which will result in comparable noise ratings and more acceptable systems.

The application of electronic control systems to various heating and air conditioning requirements can best be done when the fundamentals are fully understood, according to John Schwartz in his third and concluding article in this series on page 122.

Do you agree with the philosophy of hospital engineering as explained by J. A. Millard in his article on page 128? Mr. Millard is an engineer who has long been associated with the problem of coordinating engineering and medical techniques. He explains what he believes is necessary for proper operation and maintenance of complicated mechanical equipment in today's modern hospitals. Of course many of the principles apply across the board to all types of heating, piping, and air conditioning installations in most large buildings. Your experiences and comments are invited as I am sure others will be interested.

The research report on the subject of finned streamlined heat exchanger tube performance on page 131 is worthy of your study. It has been prepared by David Adams in which he shows how the increased heat transfer effectiveness with this type of finned tubes will permit reduction of the size of a single bank heat exchanger by as much as 35 to 50 percent. Mr. Adams shows how pressure losses range from $\frac{1}{4}$ to $\frac{1}{2}$ those for finned circular tubes with corresponding reduction of air pumping requirements of 4 to 16 percent for a given air velocity. While not commercially available at present, this research may well indicate the shape of heat transfer surface in the future.

The question, "Will higher boiler temperatures cause corrosion and other problems? is answered by four readers on pages 88 and 92. Perhaps your experiences on this or some other problem would be of interest to other engineers. I would like to hear from you as an exchange of these ideas and experiences is helpful to many.

The You'll Want to Know news items and other short reports are on pages 43 to 46. Other items of interest are also presented on pages 149, 184, 196, and 201.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

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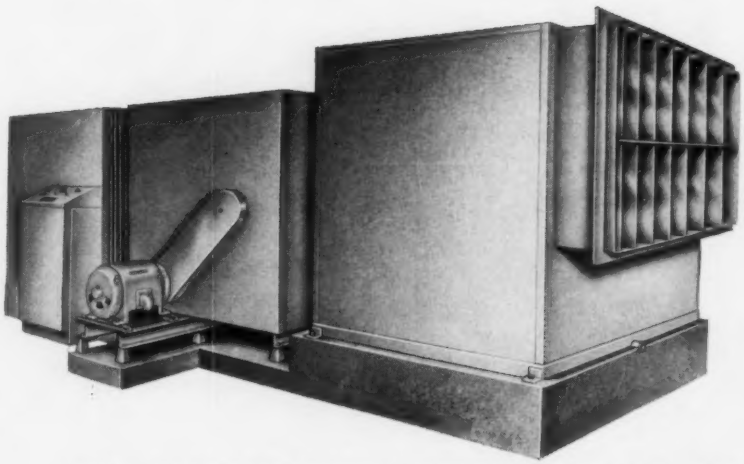

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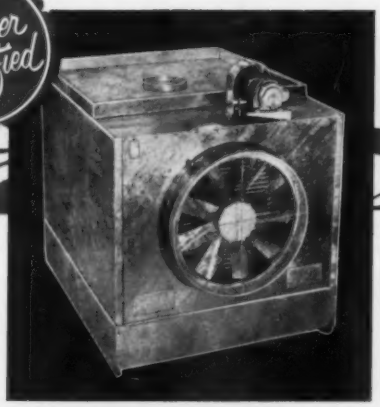

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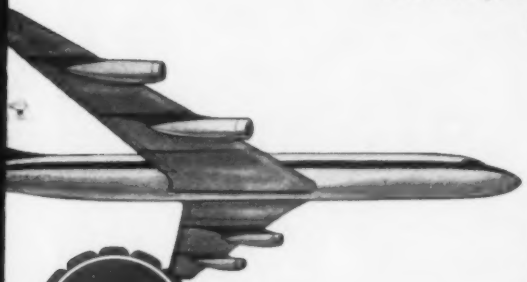
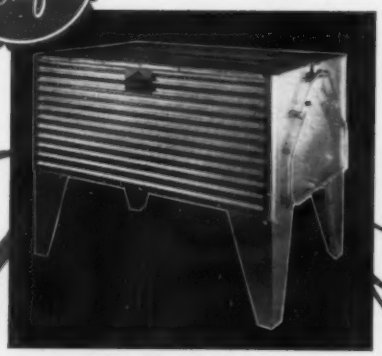
JUST SEND THE NAMES OF CUSTOMERS

Who have purchased Cooling Towers or DriCoolers since February 1, 1961 — **that's all**



Customer Certified

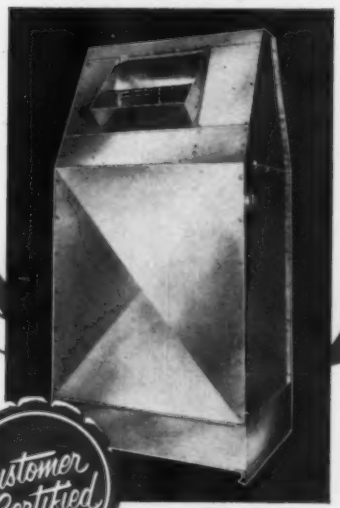


DRICOOLERS®

Air cooled refrigerant condensers engineered for durability, controllability, compatibility. Efficient blow-through design adaptable to any location. Damper control for fool-proof, low-temperature operation of single- or multi-circuit units. Exclusive PreCooler overcomes high dry bulb temperatures.

AQUACOOLERS®

Whisper-quiet, leak-proof operation makes AquaCoolers especially suited for indoor installation. Air delivery adjustable to accommodate ductwork pressures. Minimum assembly requirements permit quick, easy installation. All models hot dip galvanized for long service-life.



Customer Certified

THE MARLEY COMPANY

222 West Gregory Blvd.
Kansas City 14, Mo.

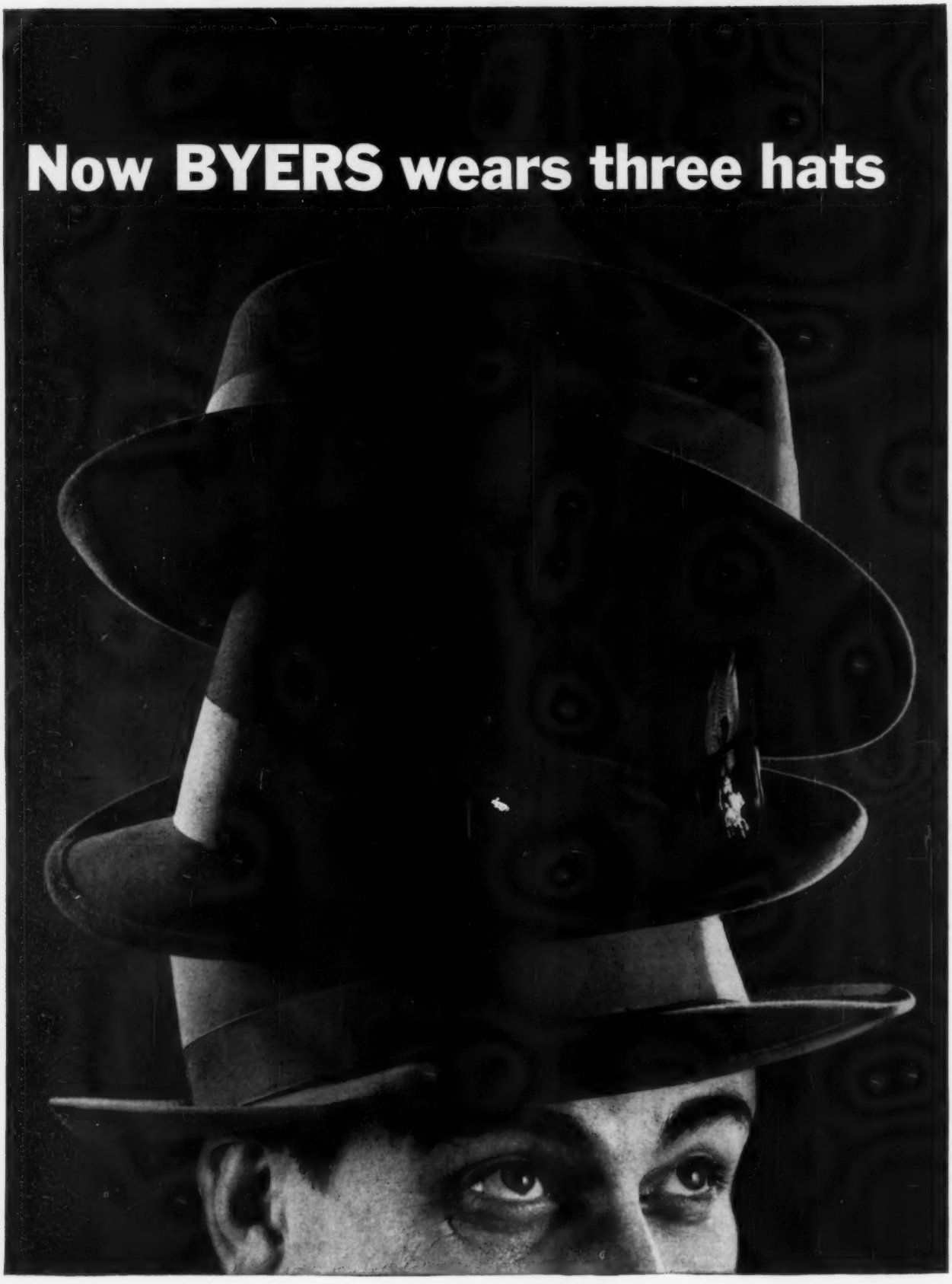
Send me immediately information on your "Customer Certified" program that offers bonuses for owner education.

Contractor_____

Company_____

Street_____

City_____


Now BYERS wears three hats

. . . single source
for 3 important piping materials:

BYERS WROUGHT IRON, PVC, STEEL PIPE

Addition of *steel* pipe to our tubular product line enables Byers field service and engineering service departments to assist you by giving unbiased opinions on what piping you should use in various services.

* * *

From our comprehensive technical library on piping material we know that:

Wrought Iron Pipe—is a proven material in such services as brine lines, heating and drainage systems, to mention just a few.

PVC (polyvinyl chloride) Pipe—is used in areas where acids and alkalies are deadly to metal pipe, also where electrolysis causes early pipe failure.

Steel Pipe—is the workhorse of the piping field and used in services where initial economy is a major consideration.

Additional details on one or all three piping products can be had by writing or phoning A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

. . . and the plus factor is BYERS 97 years of piping experience

PIPING PRODUCTS: Wrought Iron • PVC • Steel
ROLLED PRODUCTS: Plates, Billets and Bars • Wrought Iron • Stainless and Alloy Steel

Coming soon from

NEW! Simple field test for hermetic burnouts

plus

NEW! Easy way to clean out mildly contaminated systems

Full information on these important new developments—plus test kits and pressurized cylinders of "Genetron" 11—will be available from your wholesaler about March 15. See him then!

General Chemical

General Chemical takes the guesswork out of hermetic burnouts

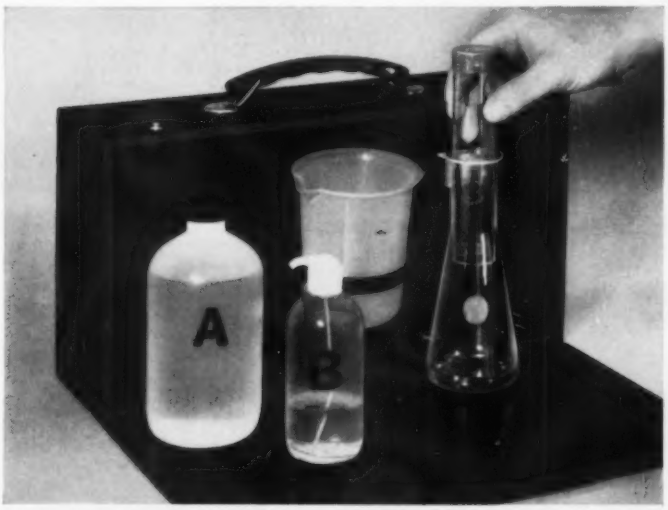
One of the oldest and toughest service problems in the refrigeration and air-conditioning industry has been licked!

Until now, there was no quick, on-the-spot test to determine the degree of acidity in a system after hermetic burnout . . . and there was no easy way to tell when the acid in a system had been cleaned out.

To solve this problem, General Chemical has developed the first simple field test for checking degree of contamination in a burned-out system—before and after cleanout. Yes – we've taken the guesswork out of hermetic burnouts.

In addition, General Chemical has developed an easy, short-cut procedure for cleaning out mildly contaminated systems by using pressurized cylinders of "Genetron" 11 to flush the unit – quickly and without pumping.

See how these new developments can save you time, labor and material costs:



First practical field test method! With this handy, portable kit developed by General Chemical, you can now quickly and easily determine extent of contamination in a system after hermetic burnout. Simple tests show extent of burnout contamination and what clean-up procedure should be used. Also show when cleaning is complete.

New quick, easy way to clean minor burnouts! Mildly contaminated systems can now be flushed and cleaned without pumping by using special new pressurized cylinders of "Genetron" 11 solvent. Prepared especially for flushing burnouts, these pressurized cylinders will soon be available from your wholesaler. An excellent solvent, "Genetron" 11 flushes acids and moisture, loosens and removes solids and is safe to handle.

Here is still another contribution by General Chemical to the advancement of the air conditioning and refrigeration industry. These new procedures will be demonstrated at the International Heating & Air-Conditioning Exposition, Chicago, February 13-16, at "Genetron" Booth #43 . . . and will be shown to RSES and other groups throughout the country in weeks to come.

genetron®
super-dry refrigerants

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.

Easily-installed PPG Neoprene-coated Duct Liner now meets fire requirements, provides extra margin of safety on ductwork installations.

NOW—PPG Fiber Glass Duct Liner Carries the UL Label

PPG Neoprene-Coated Superfine Duct Liner Meets All Requirements of NBFU Bulletins No. 90-A and 90-B for Ducts

YOUR ASSURANCE OF SAFETY

PPG is proud to announce that its Neoprene-coated Superfine Fiber Glass Duct Liner has been thoroughly tested according to the condition determined by National Board of Fire Underwriters, and has met the Board's rigid safety requirements in compliance with Bulletins No. 90-A and 90-B for ducts. It now bears the label of the Underwriter's Laboratories, Inc.

For you, this means that PPG Neoprene-coated Fiber Glass Duct Liner meets fire requirements and provides that extra margin of safety on any ductwork installation.

PLUS ALL THOSE EXTRA PPG ADVANTAGES...

. . . such as lightweight, easy handling, easy cutting and piecing, low wastage, fast installation, fine acoustical qualities, good thermal barrier characteristics, low resistance to air flow, no air erosion; and lifetime service, because it won't rot or decay, is not affected by humidity or dryness.

Give PPG Fiber Glass Duct Liner a try. It offers you a combination of top-flight insulation and economy. For full information, call your nearest PPG Fiber Glass Sales Office, or write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

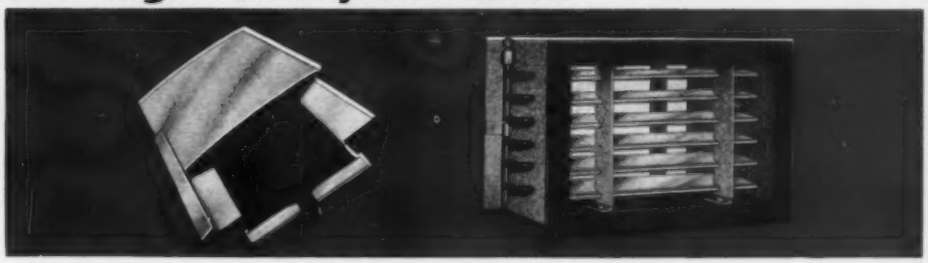
Sales Offices: Atlanta, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Fort Wayne, Houston, Jacksonville, Kansas City, Los Angeles, Louisville, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle and Washington.

FIBER PPG GLASS PITTSBURGH PLATE GLASS COMPANY

NOW... IN AIR DISTRIBUTION
CONNOR MAKES THE *COMPLETE* CONTRIBUTION

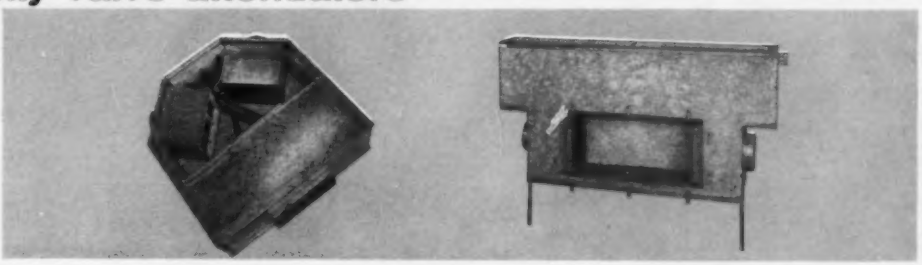
low – medium – high velocity air valves

PNEUMAVALVE—a contribution made only by Connor—adapts with equal facility anywhere that air must be controlled. Needs neither mechanical linkage nor operators. Response is instantaneous, positive, linear. No hysteresis. Minimum turbulence. A range of sizes. Bulletin K-45.



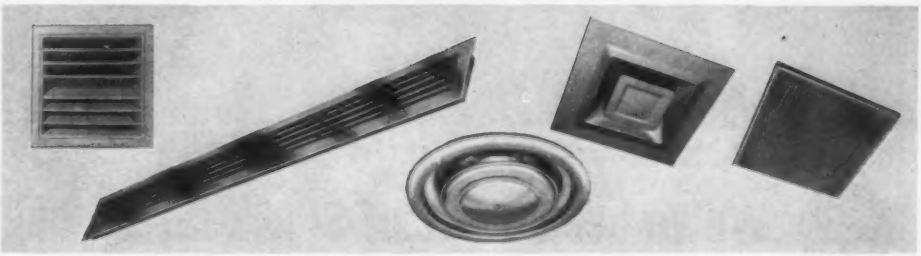
high velocity valve attenuators

At the heart of every model in Connor's Series 45P line is PNEUMAVALVE, the exclusive element that makes this Series superior for fault-free, ultra-quiet, minimum-maintenance performance. Shown are the DPC total constant volume Ceiling unit, left, and the unique DPW total constant volume Under-Window Sill-Slot unit. Bulletins K-33A, K-46, K-52, 31F.



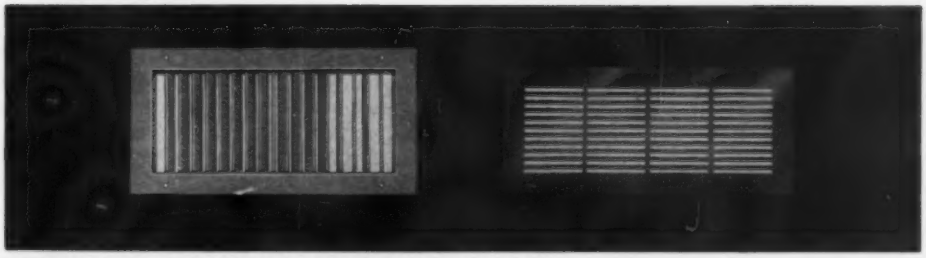
air diffusers

Shown are representative models in the complete Kno-Draft air diffuser line . . . adjustable and fixed pattern. Smart, simple styling that blends perfectly, unobtrusively with any interior, most recent additions are the KSS multi-pattern diffuser, extreme left, and the KO perforated diffuser, extreme right. Bulletins K-20A, K-27A.



grilles and registers

The extensive Kno-Draft line of grilles and registers offers a wide variety of face designs and rectangular configurations. Units that permit two-directional air flow, positive air volume control, other desirable features are available. Bulletin K-40.

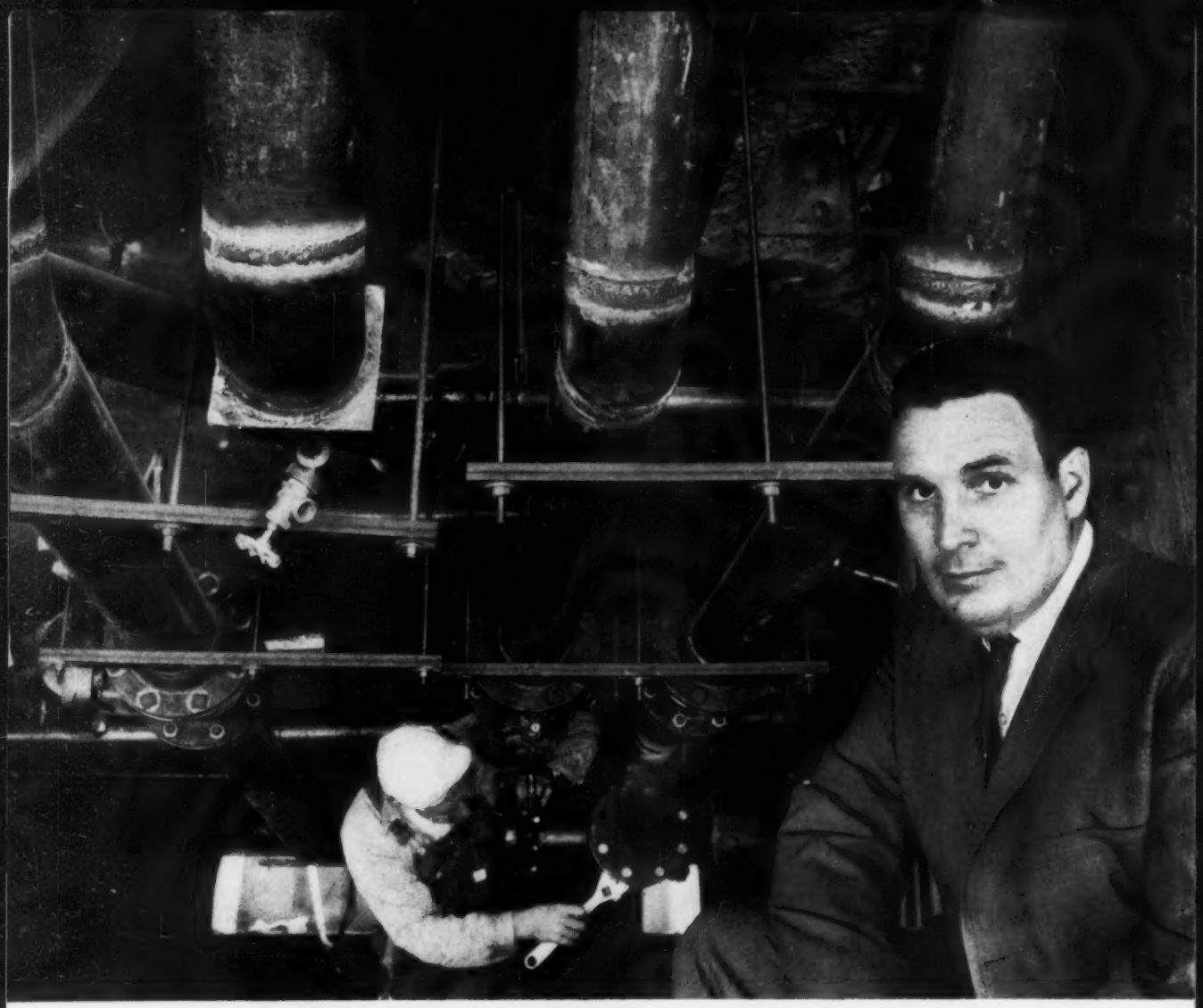


SEE THEM ALL AT BOOTH 142, INTERNATIONAL HEATING AND VENTILATING SHOW, FEBRUARY 13-16, 1961.

CONNOR

CONNOR kno·draft® AIR DIFFUSERS

DANBURY • CONNECTICUT



Spang Steel Pipe serves the combination heating and cooling system at the deluxe 888 Logan Apartments, Denver, Colorado

"We've been users of SPANG Steel Pipe for 15 years"

— says Mr. Arthur Riley, President, Riley Engineering Corporation, Denver, Colorado

"...and we know SPANG more than amply meets our rigid requirements!"

That's what Mr. Riley told us at the 12-story 888 Logan Apartment Building job site, where he was supervising the installation of over two miles of SPANG Steel Pipe in the combination hot water heating and chilled water cooling system.

"Frankly," says Mr. Riley, "we depend on the quality control exercised in the manufacturing processes of SPANG. Our reputation is at stake on every job, and we depend heavily on the materials used in a project. We know SPANG is among the best pipe available."

In reply to our question about SPANG Pipe's outstanding features, Mr. Riley stated, "SPANG is easy to work with, it has good welding characteristics, its quality is consistent, it's durable, and we get good service."

Get all these advantages from SPANG Steel Pipe on *your* next job. You can't buy a better pipe! Let your local SPANG Distributor serve you soon.

SPANG Steel Pipe is one of the many fine products made by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.*

Steel's Symbol of strength, long life, and economy

Architects:
W. C. Muchow and Nat S. Sachter, Denver
Consulting Engineer:
Riley Engineering Corporation, Denver
Builder: Al Cohen, Denver
Plumbing Contractor:
John F. McCauley, Denver
Heating and Air Conditioning Contractor:
Louis Cook, Denver
Spang Distributor:
Great Western Pipe Company, Denver

ARMCO National Supply Division

"SURE IT'S RUNNING! YOU CAN TELL IF YOU TOUCH IT!"

B&G UNIVERSAL PUMPS ARE NOW AVAILABLE IN SIZES TO 75 H.P.

B&G Universal Pumps for larger forced hot water systems are extra quiet, extra smooth in operation. They are designed and built specifically for one job—to satisfy the exacting demands of circulated water systems...no special vibration eliminators or flexible connections to the piping are needed.

Motors are built and selected for *quiet* operation; long *sleeve* bearings are used in both motor and pump, and the oversized shaft is special alloy steel with an integral, heat-treated thrust collar. Water leakage is prevented by the exclusive diamond-hard "Remite®" mechanical seal. Flanges, bolts, nuts and gaskets for both suction and discharge sides, pet cocks for venting and gauge tappings are furnished without extra charge.

Now added to their numerous design advantages is an increase in sizes to 75 HP, 2000 GPM, 170 ft., 1750 RPM, 3″—4″—6″—8″ discharge connections. Every conceivable circulation requirement of systems using water for heating and cooling can be satisfied within the wide capacity range of B&G Universal Pumps.

Send for descriptive literature and engineering data

BELL & GOSSETT
COMPANY
Dept. GN-5, Morton Grove, Illinois

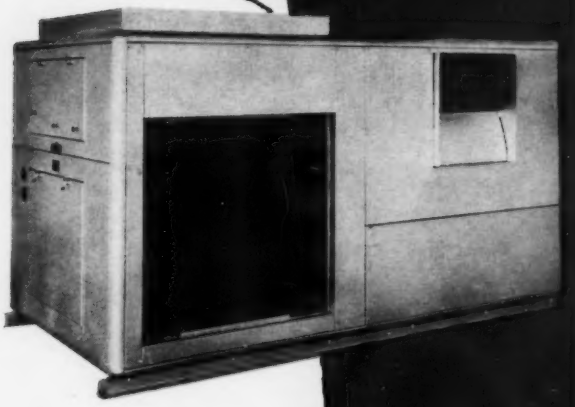
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

Governair

COMPLETELY SELF-CONTAINED

AIR COOLED

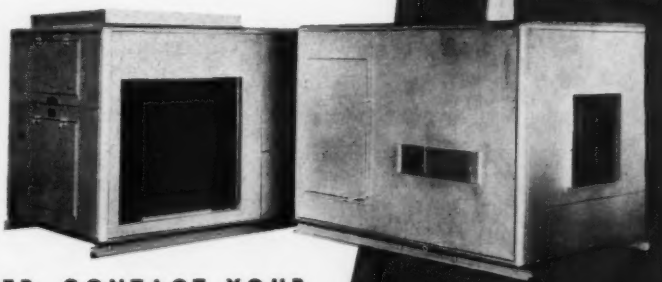
PACKAGE UNIT TYPE SCAC



GOVERNAIR'S SCAC is available in six basic models from 10 through 40 ton capacities. Typical GOVERNAIR flexibility has been maintained with a choice of 4, 5, or 6 row cooling coils offered to meet all capacity requirements. Roof mounting has been considered in the Low-Silhouette arrangement.

The basic one-piece cooling unit is housed in a rugged weatherized cabinet and mounted on rails. It is completely wired, charged and tested at the factory. Demountable and remote arrangements are available, and accessories include choice of filters, face and by-pass dampers, reduced voltage starters, Low Ambient Control, and the Gas Fired Furnace Section.

YEAR-'ROUND AIR CONDITIONING is accomplished by the use of the gas-fired furnace section. This accessory consists of a complete and unaltered gas-fired duct furnace housed in a Weatherized Cabinet with an integral by-pass damper arrangement. Refrigerated air may completely by-pass the furnace, while any desired amount of air is diverted through the furnace during the heating cycle.



FOR AN INFORMATIVE FOLDER, CONTACT YOUR LOCAL GOVERNAIR REPRESENTATIVE OR WRITE

GOVERNAIR

4840 N. SEWELL
OKLAHOMA CITY

NEW

line voltage THERMOSTAT with front panel control of all heating-cooling functions!

Series 822

How settings are locked

Where it is desirable to lock settings, installer removes cover and pushes out factory-installed key "B" from each adjusting knob. This disconnects knob from adjusting shaft. Then, user may insert special key "A" (supplied for key chain use) through knob slot and turn to make desired settings . . . remove key and thermostat is locked as adjusted.

Take your choice...heating, cooling or heating-cooling...each features unique, easy-to-use, locking-type knobs

Here's the line voltage thermostat that has "everything" desired for accurately controlling temperature in motels, schools, offices and similar installations.

It has easy-to-read temperature and function selector dials. It has an accurate bimetallic thermometer with vertical dial. It has exclusive, locking type adjusting knobs, attached to cover but connected to adjusting shafts by factory-installed "keys" within the knobs. It has a unique, built-in but concealed adjustable high limit stop for temperature dial. It has an unusually sensitive element and mechanism which provide low operating differential at all voltages and all amperages within its rating. It has easiest "field wiring" ever... simply connect to large terminals *on back of thermostat.* And, it has modern "thin-line", compact styling. Learn more about this new thermostat... write to the Penn factory for Bulletin 3233.

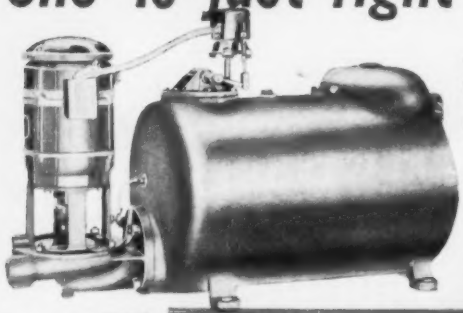
PENN CONTROLS, INC. Goshen, Indiana

EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

Specify Skidmore HEATING PUMPS

One is just right for your application



TYPE "VC" PUMP — cast iron construction . . . low inlet connection easily accessible — capacities, 1,000 to 65,000 sq. ft. E.D.R. — discharge pressures from 10 to 75 lbs.

TYPE "UV" PUMP — designed for low return installations — featuring new wide range of sizes, capacities and pressures. Send for new bulletin No. 19-B which contains complete engineering data and capacity table.

TYPE "VC" PUMP

TYPE "UV" PUMP

SKIDMORE VACUUM PUMP—SINGLE UNIT
(ALSO FURNISHED IN DUPLEX)

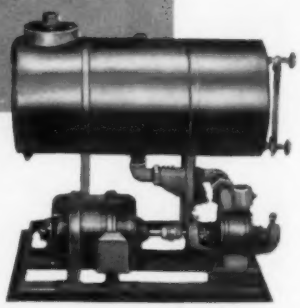
MAINTAINED EFFICIENCY . . . automatically adjusts itself to the varying conditions.

Low return lines . . . reduces installation cost, often eliminating the necessity of a pit.

Capacity remains constant year after year . . . eliminates adjustments and costly repairs.

TYPE "HS" PUMP

Sturdily constructed for dependable service at small investment —capacities, 1,000 to 65,000 sq. ft. E.D.R. discharge pressures from 10 to 75 lbs.



TYPE "TM" PUMP

Completely assembled on either steel or cast iron base — capacities, for boilers up to 250 H.P. discharge pressures to 150 lbs.

TYPE "CCVS" PUMP — features close-coupled design and mechanical shaft-seal — single unit is built with 5, 10 and 20 gallon receivers. Send for new bulletin No. 21-C which fully describes both single and duplex units.

Send for bulletins on all Skidmore Pumps

SKIDMORE PUMPS

SKIDMORE CORPORATION ST. JOSEPH MICHIGAN

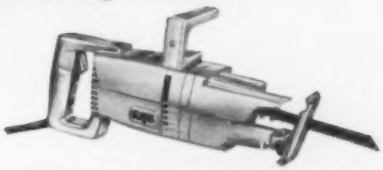
Cuts 2-inch cast iron pipe in less than 2 minutes!

New Skil Model 701 . . . world's only portable electric, metal-cutting hacksaw!

This all-new, Skil Model 701 Recipro Saw —companion to the Model 700 all-purpose Recipro Saw—is the only portable power saw made specifically for fast cutting of any metal or highly abrasive material, including stainless, cast iron, metal lath and building tile.

It has 2 speeds; 1000 and 1400 strokes per minute for extremely fast cutting of different gauges and densities of metals and with longest blade life. Standard equipment includes steel carrying case and 4 assorted blades.

Ask your Skil distributor to demonstrate either or both Recipro Saw models. Look under "Tools-Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 134B, 5033 Elston Ave., Chicago 30, Ill.



Improved All-Purpose Model 700! Newest version of world's first 2-speed reciprocating saw. 2600 s.p.m. speed for metal; 3500 s.p.m. speed for wood, compositions, plastic.

SKIL . . . and SKILSAW POWER TOOLS

BUY SPORLAN *Catch-Alls*

. . . the Perfect Filter-Drier for every capacity
from fractional horse-power units to large capacity installations

Sporlan offers a complete range of Catch-Alls engineered to fit every application, from domestic refrigerators, small freezers and vending machines to the largest commercial and industrial refrigeration and air conditioning systems, with every conceivable job size in between.

No matter how large or small the job you are planning, your filter-drier worries stop when you buy Sporlan Catch-Alls.

In addition, the Sporlan Catch-All is the perfect filter-drier because . . .

- Desiccants are molded into a porous core.
- Maximum drying through highest degree of activation.
- Filtering instead of straining.
- Superior acid removal.
- Refrigerant cannot channel through or by-pass around the core.
- Core will not powder or pack.
- Full line flow protection for any size system.
- Connections are protected by moisture and tamper-proof seals.

See your Sporlan Wholesaler for your Catch-All needs today and ask him for a copy of Bulletin 40-10.

See you at
Booth No. 1254
15th INTERNATIONAL
HEATING & AIR CONDITIONING EXPOSITION
Chicago, Illinois February 13-16, 1961

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS 17, MISSOURI

EXPORT DEPT. • 85 BROAD STREET • NEW YORK 4, N. Y.

A MOST SIGNIFICANT BREAK-THRU IN THE HISTORY OF AIR CONDITIONING

Soon you can have it! HI-PRESS AIR CONDITIONING OF AMERICA, INC., pioneer developer of small-pipe high-velocity air systems used in over 500 ships the world over, is fast readying this revolutionary concept for adaptation to a multitude of industrial/commercial applications on Land. (Pssst... listen! This small, twin-pipe system requires half the space needed for conventional ductwork; special pipe and fittings are Aerodynamically designed, noise attenuating; special clamping device gives leakless construction.)

A MOST IMPORTANT NEW TEAM IN ALL THE INDUSTRY

On December 15, 1960, the big news broke... about our spirited new combo: HI-PRESS and DRAYER-HANSON, who then became a Division of Hi-Press. This most logical welding of two key names constitutes a 500% growth factor. It means limitless facilities, talent, "know-how" are high-gearing to give you all the excitement noted above, plus a bold, broad line-up of air conditioning and refrigeration products to thoroughly "pace-set the Sixties." D-H—since 1910 a leading designer/manufacturer of quality air conditioning and refrigeration! HI-PRESS—the big name in Marine air conditioning. Watch us GO!

drayer-hanson
DIVISION OF
HI-PRESS AIR CONDITIONING OF AMERICA, INC.*

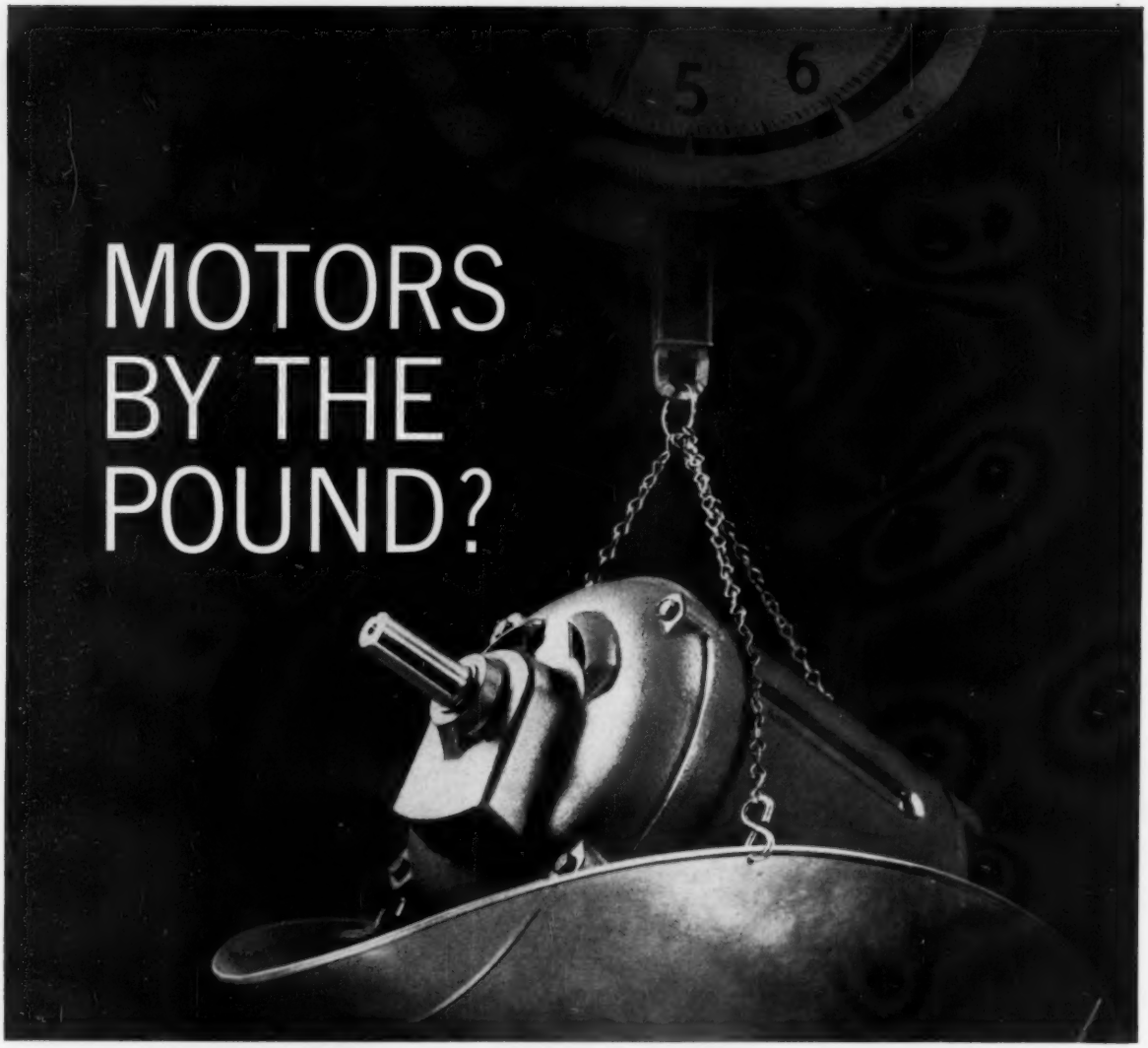
d-h

H-P

THE MOST URGENT THING FOR YOU TO DO RIGHT NOW...

If you are: (1) "itching" for details, (2) have even a remote interest—Get to Chicago, February 13th through 16th! Or, keep your eye on The 15th International Heating & Air Conditioning Exposition. We'll "peek-preview" these exciting developments—Booth #1172—under the proud new banner of HI-PRESS AIR CONDITIONING OF AMERICA and DRAYER-HANSON DIVISION, HI-PRESS. Meanwhile, call a Drayer-Hanson sales agent near you or receive the Full Facts on our products by contacting us now.

*Administrative Offices: Los Angeles—3301 Medford Street · New York City—Chrysler Building, 405 Lexington Avenue / Main Plant: 3301 Medford Street, Los Angeles 63, California



You're buying motors by the pound when price is the only consideration

Sure, you can get a motor for the lowest price, a motor of the same type and with the same rating and operating characteristics of the highest priced motor. But, while initial price is an important factor, the actual cost is the ultimate cost of a motor. And, ultimate cost includes the repair bills, lost production, lost man hours and lost customers that an inferior, built-down-to-a-price motor could cost you.

Wagner® protected polyphase motors do cut expensive downtime. Their cast iron frames can't be affected by corrosive acids, salts, or alkalies. They are designed for cool running . . . stator temperatures stay low to increase motor life. Wagner polyphase motors are designed to permit relubrication that adds years to motor life under severe operating conditions. Wagner motors have earned a reputation for proven dependability.

Next time you buy motors, check beyond the purchase price. Make sure that you get all the performance you need—with motors that will do the job.

Wagner motors have been getting the job done for more than 65 years. Your Wagner Sales Engineer will be glad to show you why. Call him for an analysis of your next motor application, be it for plant or product.

Branches and Distributors in all Principal Cities

Wagner Electric Corporation

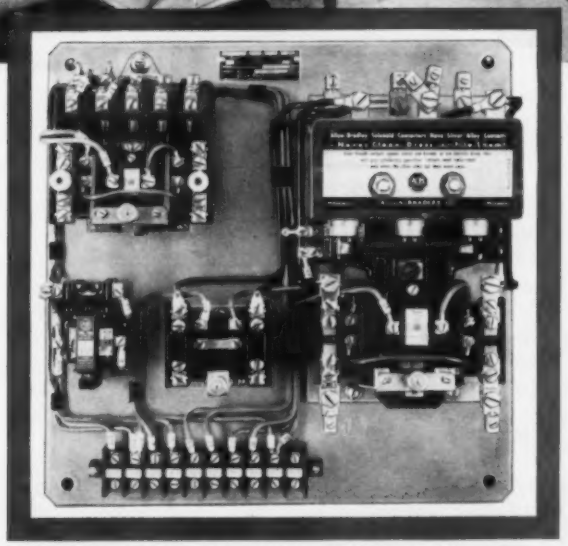
6370 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

WH61-6

Allen-Bradley Control

for the Air Conditioners on North Western's New Bi-Level Commuter Cars

Two of these 8-ton Trane self-contained units provide the air conditioning for each of the 152 new commuter cars on the Chicago & North Western Railway.



This compact A-B control panel is used with each of the air conditioning units. All components are standard A-B catalog items.

Where "Quality" Counts!

A prime objective in the design of these modern cars was to minimize maintenance. It was only logical, therefore, to use Allen-Bradley—the *quality* motor control—for the air conditioning units.

The Allen-Bradley solenoid starter is famous for its simplicity. There is only ONE moving part—and this fact assures *millions* of trouble free operations. There are no bearings to corrode and stick—no flexible jumpers to wear and break. Also, the double break, silver alloy contacts—used throughout the A-B line—*never* need servicing. All A-B starters have reliable and permanently accurate overload relays that effectively protect motors against burnouts.

For the ultimate in maintenance free service through the years, insist on Allen-Bradley *quality* motor control.

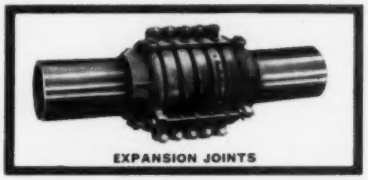
ALLEN-BRADLEY | **Quality Motor Control**

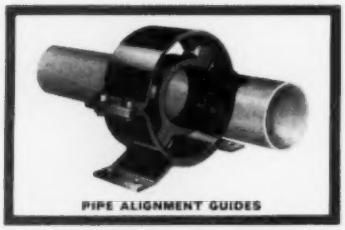
Member of NEMA

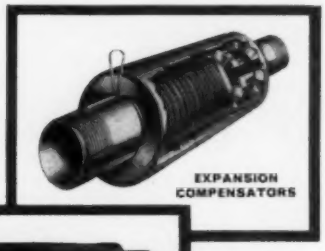
Allen-Bradley Co., 1335 S. First Street, Milwaukee 4, Wis. • **In Canada: Allen-Bradley Canada Ltd., Galt, Ont.**

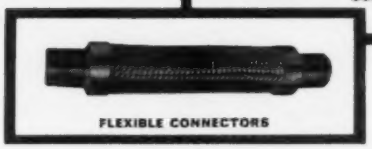
51 SOLUTIONS TO PIPE MOTION PROBLEMS

...only **1** source brings you all of them!


EXPANSION JOINTS


PIPE ALIGNMENT GUIDES


EXPANSION COMPENSATORS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ROLLER PIPE SUPPORTS

One manufacturer . . . one responsible source . . . call on Flexonics for everything you need to insure sound piping installations in the face of thermal expansion, vibration, and other forms of pipe motion.

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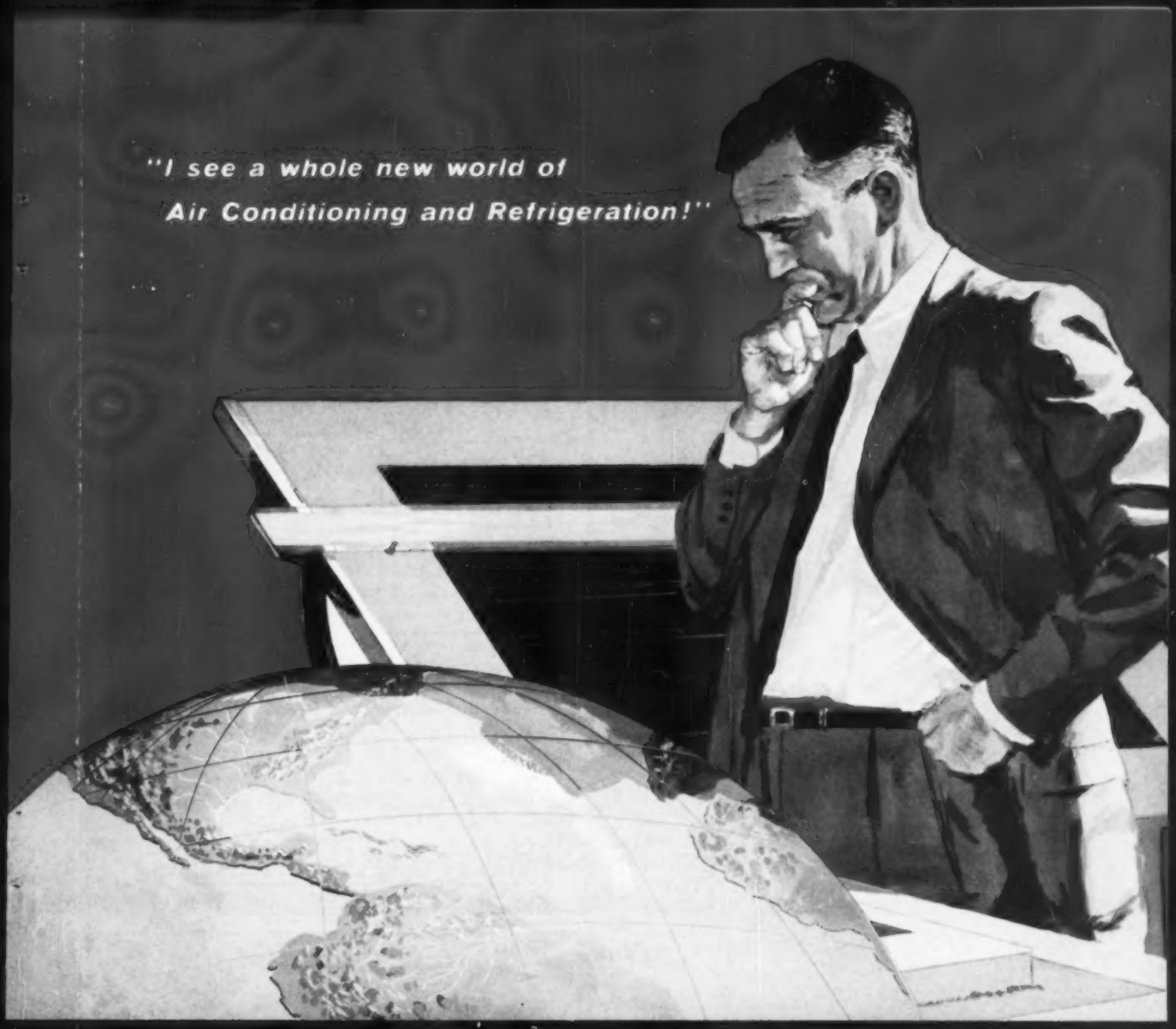


QUICK REFERENCE GUIDE

Diversified line of YORK Air Conditioning and Refrigeration Systems and Equipment . . . Designed for today's specialized applications in temperature-humidity control and air distribution.

YORK CORPORATION
Subsidiary of Borg-Warner Corp.
YORK, PENNSYLVANIA

YORKAIRE 3-PIPE SYSTEM

Delivers Heating or Cooling Instantly to any Induction or Fan-Coil Unit in a Multi-Room Building

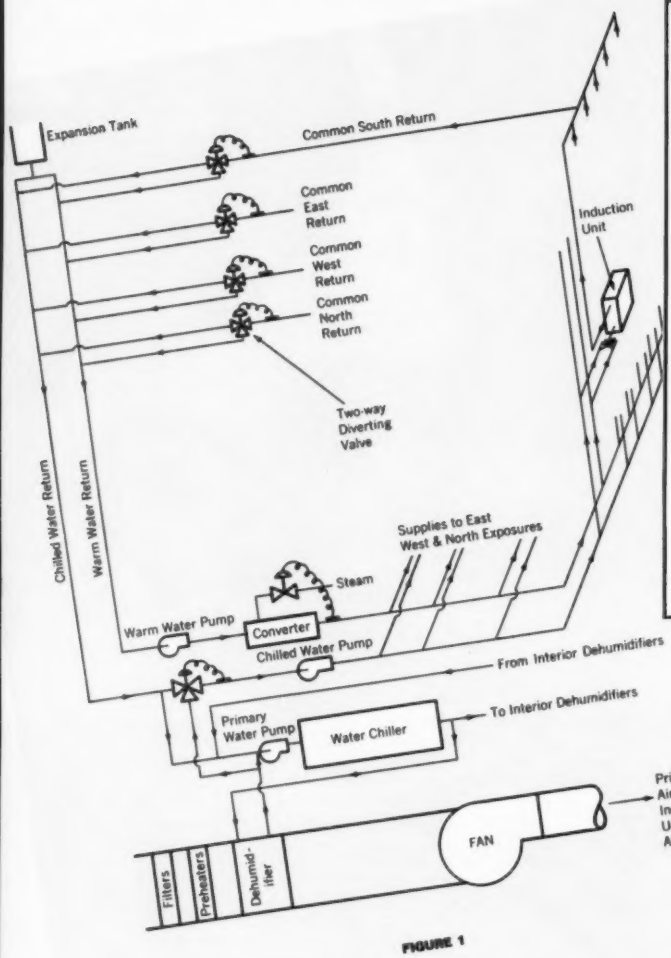
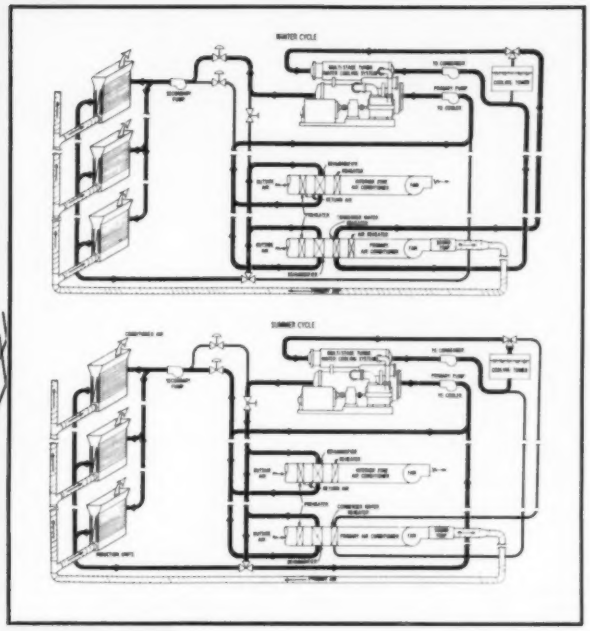
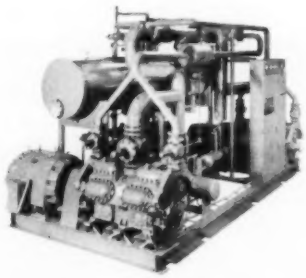


FIGURE 1





At left: Schematic diagram of Yorkaire 3-Pipe System with primary air supply.

Upper right: Schematic diagram of hot and chilled-water systems.

Lower right: View of York Heat Pump for Yorkaire 3-Pipe System.

Yorkaire 3-Pipe Systems provide unparalleled personal comfort. The occupant of each room in the building has a choice of either instant heating or cooling and ventilation when he dials his fan-coil or induction conditioner. The control valve modulates the flow of either hot water for heating or chilled water for cooling.

Costly reheaters and return air ducts are eliminated. Since primary air requirements are reduced, a considerably smaller equipment room is needed . . . freeing valuable space for other uses. Besides providing the ultimate in zoning, the entire system is unequalled for space-saving features.

YORK CONDITIONERS

Supply air for YORKAIRE 3-Pipe Systems, Conventional and Perimeter Installations

YORK HI-I

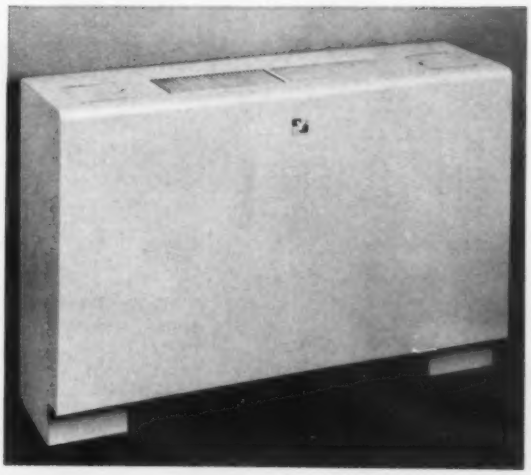
INDUCTION CONDITIONERS

York Hi-I Induction Units more than double the flow of conditioned air and sensible cooling capacity by providing High Induction of room air. This is especially important in the modern building where large glass areas and high intensity lighting create greater cooling requirements than were previously known.

With H-I induction units it becomes possible to safisfy these greater cooling requirements with a primary air system sized to meet only the minimum ventilation requirements. This reduces the equipment-space requirements throughout the building. Also, the Hi-I induction units are easily applied and installed either wall hung or floor supported. Both of these features reduce initial and installation costs below those required by conventional induction units.

YORK UNIVERSAL

FAN-COIL CONDITIONERS



New in 1961—York's UNIVERSAL line of room fan-coil air conditioners provides a wide range of models for all applications. All models are designed for quick, low cost installation. For example, ceiling hangers permit one man installation of horizontal models.

Available in four basic model sizes—200, 300, 400, 600 cfm—all models are listed with Underwriters Laboratories.

- Floor Supported Basic Model
- Wall Supported Basic Model
- Ceiling Basic Model
- Ceiling Plenum Basic Model

Available in five decorative enclosure types finished in owner's choice of four baked enamel finishes to blend with any room decor.

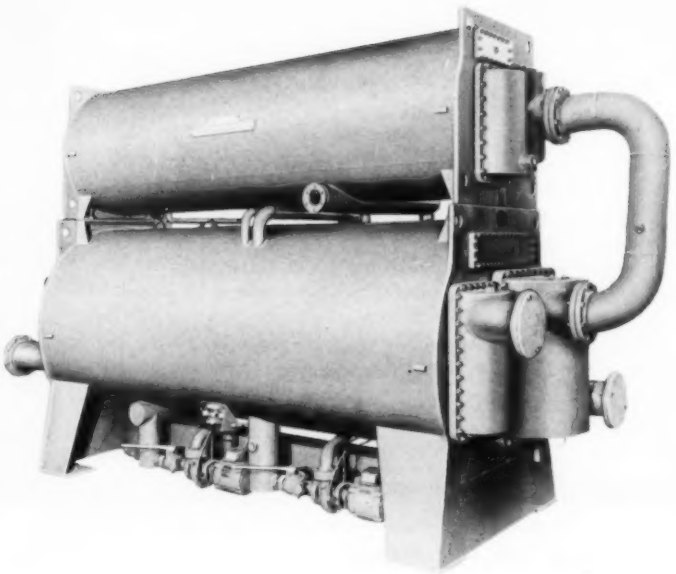
- Floor Enclosure
- Semi-Recessed Enclosure
- Off-The-Floor Enclosure
- 19″ Sill Height Enclosure
- Ceiling Enclosure

Let your York representative demonstrate to you how this wide application selection can save you money, both in system design and installation.

YORK WATER CHILLERS SUPPLY
INCLUDING YORKAIRE 3-PIPE SYSTEMS

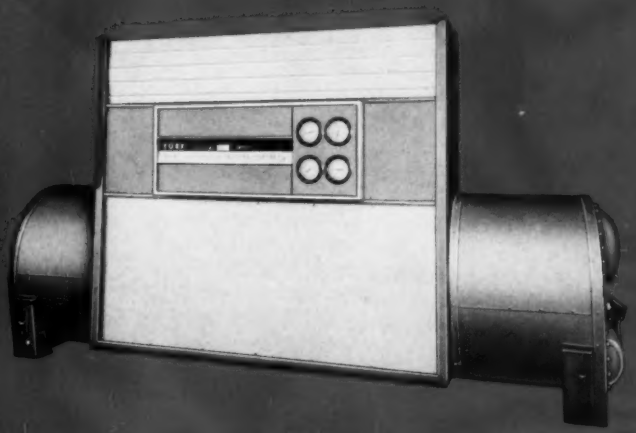
YORK ABSORPTION SYSTEMS

York Absorption Systems provide chilled water for air conditioning and process refrigeration. Operation is economical, using hot water or low-pressure steam. Capacity can be varied economically according to demand, from overload to as little as 10% capacity. Operation is quiet; maintenance is simple—three small pumps with motors are the only moving parts. Capacities 50 to one thousand tons.



YORK TURBOPAK

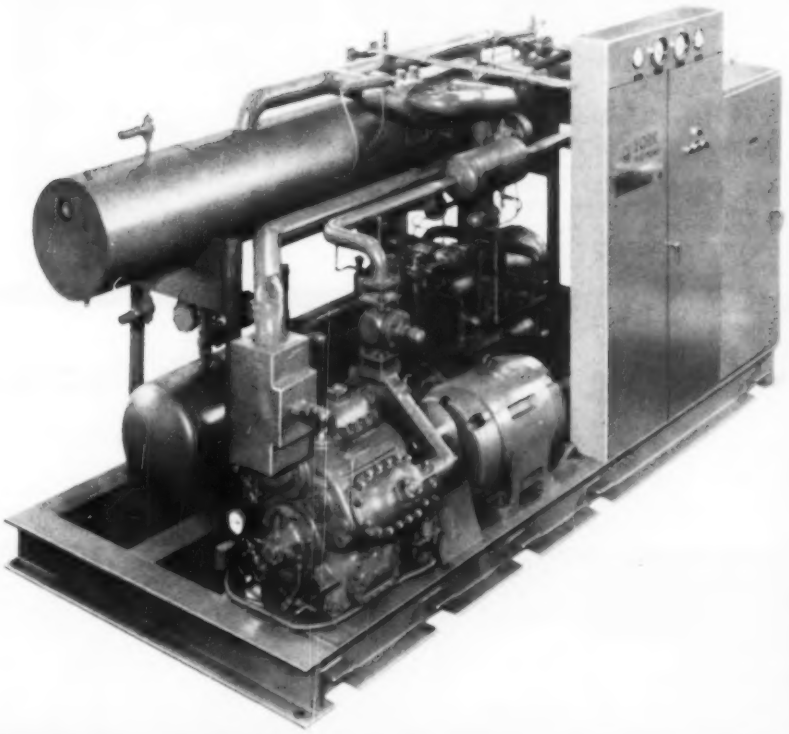
York Hermetic Turbopak Centrifugal Water Chillers provide cold water for air conditioning. Operation is quiet. Factory assembled, pre-wired, and designed to reduce floor space, weight, and installation work. Capacities from 65 to 600 tons.



COOLING FOR ALL AIR CONDITIONING SYSTEMS AND CONVENTIONAL INSTALLATIONS

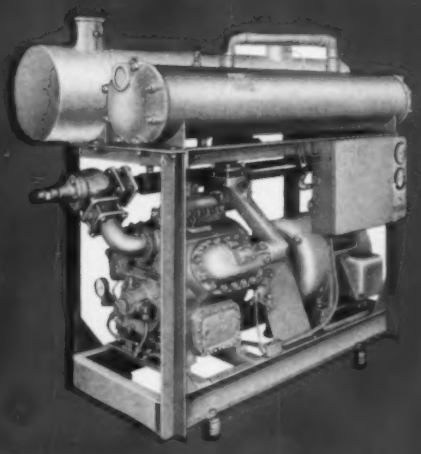
YORK HEAT PUMPS

York Heat Pumps provide both hot and cold water for air conditioning. They can cool sunny rooms and "pump" the heat to warm the shady rooms, all thermostatically controlled. Using only outside air and incoming power lines, installations are practical in cold as well as warm climates since York's multi-stage compression extracts heat from sub-freezing air. Capacities are from 50 to 150 tons, and 280 to 1,230 MBH in factory packages or custom designed to meet other requirements. Turbomaster Centrifugal Compressors extend the range to 1700 tons and larger.



YORK PACKAGED WATER CHILLER

A complete line of York Packaged Water Chillers to provide cold water for air conditioning and process refrigeration. Operation is based on product load . . . compressor step-unloads with power savings almost directly proportional. Capacities to 200 tons.

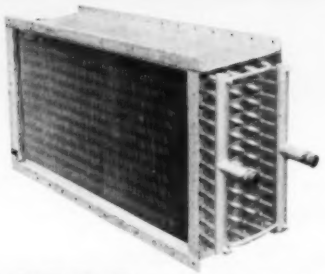


YORK CENTRAL STATION AIR CONDIT

Treat and circulate air for comfort or process work with

YORK CENTRAL STATION AIR CONDITIONERS

York Central Station Conditioners filter, cool, heat, humidify, dehumidify, and circulate air for comfort or process work. Horizontal, vertical, and multi-zone units. Capacities: 800 to 36,000 cfm.



YORK COILS York Hi-Eff Finned Cooling and Heating Coils feature high efficiency heat transfer and quality construction, designed for application ease . . . for chilled or hot water, brine, direct expansion refrigerants, standard and non-freeze steam.

YORK PACKAGED AIR CONDITIONERS utilize

comfort . . . by closely coordinating

YORK CHAMPIONS

York Champion Air Conditioners and Air-Cooled Condensing Units have up to three compressors and three fans in step sequence. Dual coils sub-cool the refrigerant. Makes possible comfort cooling even when it's zero outdoors. Available in models for ceiling suspension. Capacities: 5 to 22½ tons.

YORK COMFORT CENTERS

York Comfort Centers provide residential and gas-fired heating. Electronic filters clean the air. Capacities: 3 to 5½ tons cooling; 80,000 to 160,000 Btuh heating.

YORK EMBASSY UNITS

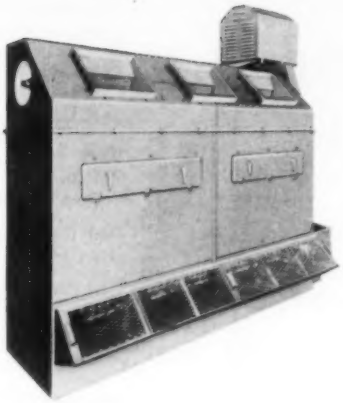
York Embassy Air Conditioners, ducts optional, provide residential or commercial cooling, which varies with load for economy. Capacities: Packaged water cooled systems—3 to 33 tons cooling; 34,000 to 645,000 Btuh heating.

IONING and CONDENSING UNITS

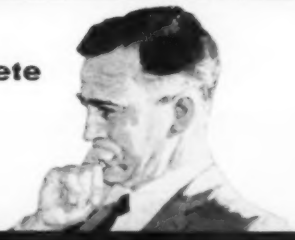
aid of Air-Cooled, or Evaporative Condensers

YORK ECONOMIZERS

York Economizers (evaporative condensers) combine the advantages of a water-cooled condenser and cooling tower usually at less cost, less space, less weight. Install indoors or out. Sectionalized. Capacities: 5 to 150 tons.

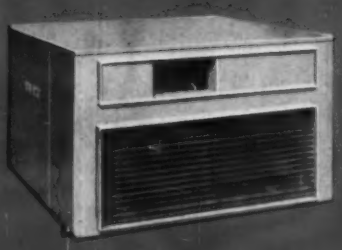


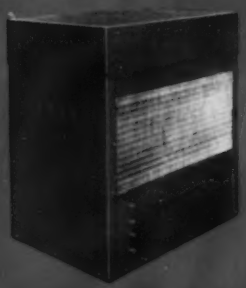
"Balanced Cooling" for complete all phases of system



YORK PATHFINDERS

York Pathfinders with twin compressors, are designed for residential and commercial air conditioning. Twin compressors have step sequence for trouble-free operation and economy. Air cooled. Capacities: 2 to 4 tons.



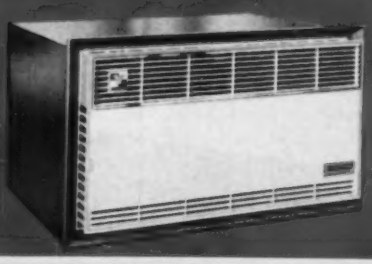


YORK TWINLINES

York Twinlines provide residential, commercial cooling. Remote heat exhaust section goes outside the building, cooling coil above furnace or in ductwork. Two, step-start cooling systems save up to 30% on operating costs. Capacities: 3 to 5½ tons.

YORK ROOM AIR CONDITIONERS

York Room Air Conditioners provide cooling and heating, with automatic temperature control. Fresh-air intake, and exhaust. Capacities: 6,500 to 18,000 Btu cooling.



Wherever you go... THOSE WHO DEMAND THE FINEST IN AIR CONDITIONING AND REFRIGERATION CHOOSE YORK

Air Conditioning

Allen Manufacturing Co.
Bloomfield, Conn.

Birch Towers
Ft. Lauderdale, Fla.

Carson, Pirie, Scott & Co.
Chicago, Ill.

Conrad Hilton Hotel
Chicago, Ill.

Flick-Reedy Corporation
Bensenville, Ill.

Foley's
Houston, Texas

Fulton National Bank
Atlanta, Ga.

Illinois Power Co.
Decatur, Ill.

Insurance Company of North America
Richmond, Ind.

Maryvale Shopping Center
Phoenix, Ariz.

Mile High Center
Denver, Colo.

Nationwide Inn
Columbus, Ohio

Statler-Hilton Hotel
Boston, Mass.

Sylvania Electric Products Co.
Amherst, N. Y.

3 Penn Center Plaza
Philadelphia, Pa.

300 Park Avenue
New York City

Refrigeration

Greensboro Ice Cream Co.
Greensboro, Md.

John Morrell Co.
Sioux Falls, S. D.

Pacific Fruit Express Co.
Ogden, Utah

Shell Oil Co.
Deer Park, Texas

Sinclair Refining Co.
Wellsville, N. Y.

Wissahickon Skating Club
Philadelphia, Pa.

Wyandotte Chemicals Co.
Geismar, La.

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Rochester 5, 471 St. Paul St.

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OHIO
Cincinnati 2, 659 East Sixth St.
Cleveland 5, 3121 Euclid Ave.
Columbus 24, 1273 Carbone Drive

PENNSYLVANIA
Philadelphia 2, Three Penn Center Plaza
Pittsburgh 22, 1613 Penn Ave.

TEXAS
Dallas 2, 1707 Cedar Springs Road
Houston 1, 2201 Texas Ave.

you'll want to know...

Bank's Electronic Equipment Requires Accurate Temperature, Humidity Control

AIR CONDITIONING the Bank of America's new building in San Francisco was a major challenge to Gayner Engineers, consulting engineers for the project. One South Van Ness, a $17 million eight story structure, contains 13½ acres of floor space, which makes it the largest in the San Francisco area. In addition, the complex electronic and mechanical equipment used in banking services demand accurate temperature and humidity control.

The main air conditioning plant is centrally located on the sixth floor to minimize the size of vertical ducts required and to preserve basement and ground floors for banking use. The system is a double-duct, low temperature differential type, moving a high volume of air at low velocity. Temperature is controlled to within a 5 F range.

Cooling is provided by two 550 ton chilling machines, a 595 ton steam absorption unit, and two systems. One system supplies the north half of the building, the other the south half. Each includes a main supply and a main exhaust fan, an air filter, a central supply duct, heating and cooling coils, and separate hot and cold air ducts.

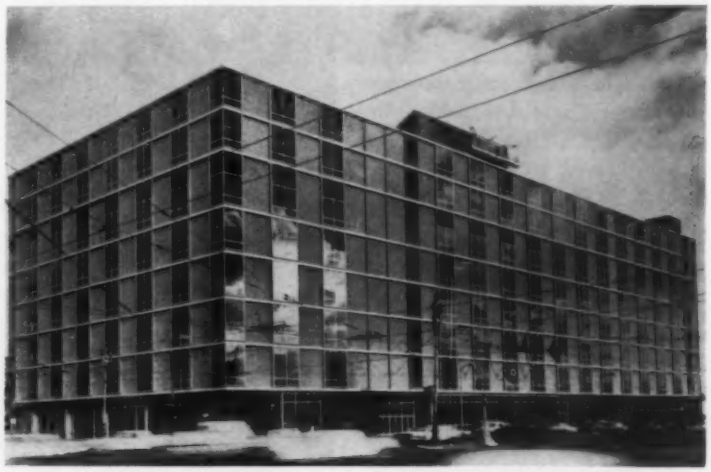
Four main fans, mounted in pairs, have 6 ft diameter squirrel-cage wheels, fluid driven by two 200 hp electric motors. These fans deliver 600,000 cfm of air. Fan bases are 18½ ton concrete slabs which "float" on spring-type vibration isolators. Air is cleaned by 50 × 17 ft changeable filters.

The central supply ducts are the size of small auditoriums, 54 × 52 × 14 ft. Walk-in air locks provide safe entry for operators. Return ducts, recirculating about 85 percent of the building's air into these spaces, are equipped with sound traps. Air from the central ducts feeds through heating and cooling coils into hot and cold ducts which supply the second through the eighth floors.

The basement and ground floors are supplied by conventional 78,000 cfm ventilating equipment which is located in the basement. A 94,000 cfm garage exhaust system eliminates fumes from auto spaces in basement, the ground floor, and the mezzanine.

Zone mixing boxes on each floor mix the hot and cold air to the desired temperatures.

A push-button remote control panel and diagram on the sixth



ONE SOUTH VAN NFSS, Bank of America's new building in San Francisco, will house a staff of 1600 serving the bank's Bay Area branches

you'll want to know

floor control the air conditioning units. A similar panel in the basement operates the basement and ground floor systems. By pushing buttons, the operator can read temperatures at all points inside and outside the building, know what units are operating, and start or stop them.

Heating coils are supplied by two boilers in the basement with a combined capacity of 13,390,000 Btu per hr. Heat removed from building spaces is dissipated by a 5000 gpm water cooling tower on the roof. The heating, ventilating, and air conditioning contractor for the One South Van Ness installation was the Scott Co.

ONE of four main fans, this 10 ft high unit will deliver 150,000 cfm of air in the double-duct system

Ventilation Conference Scheduled for Feb. 20-23

DESIGN INFORMATION and practical solutions for better air handling will be presented at the 10th Annual Industrial Ventilation Conference to be held February 20-23, 1961 at Michigan State University. The conference is co-sponsored by the College of Engineering and the Division of Occupational Health of the Michigan Department of Health in conjunction with the University's Continuing Education Service.

Information about the conference may be obtained by writing to 10th Industrial Ventilation Conference, Continuing Education Service, Michigan State University, East Lansing, Mich.

Largest UPVC Drainage System Serves New Medical Center

A $27 MILLION medical center in Lexington, Ky. is the site of what is believed to be the largest installation of unplasticized polyvinyl chloride waste drainage piping in the country, according to Tube Turns Plastics, Inc.

The installation is in the medical sciences building of the University of Kentucky's new medical center.

The building is roughly the size and shape of a football field with a T-shaped projection on one side. It is fire proof, with a reinforced concrete frame, concrete floors, and brick exterior.

The drainage system, which handles a variety of acids and solvents, reaches every area of the building's six floors and a basement with more than 12,000 ft of UPVC pipe and 2700 UPVC drainage fittings that range from 1½ to 6 in. in diameter.

The 2700 fittings include standard 45 and 90 deg elbows, tees, and couplings; long radius 90 deg elbows, y-branch tees, and y-branch cross tees; 45 deg y-branches and y-branch crosses; increaser bushings, plugs, test tees, cleanout ferrules, and almost 300 P-traps in the system.

The systems were designed by Proctor-Ingels, consulting engineers, and the mechanical contractor for the installation was Freyn Brothers.

PIPING CREW foreman on construction site of University of Kentucky's new $27 million medical center adjusts 4 in. riser into 6 × 4 in. reducing coupling

Ceilings Supply Air Diffusion, Give Acoustical Treatment

AIR DIFFUSION in the general office building of the Armstrong Cork Co. in Lancaster, Pa. is accomplished with the use of perforated mineral tile suspended ceilings which also serve as sound absorbers.

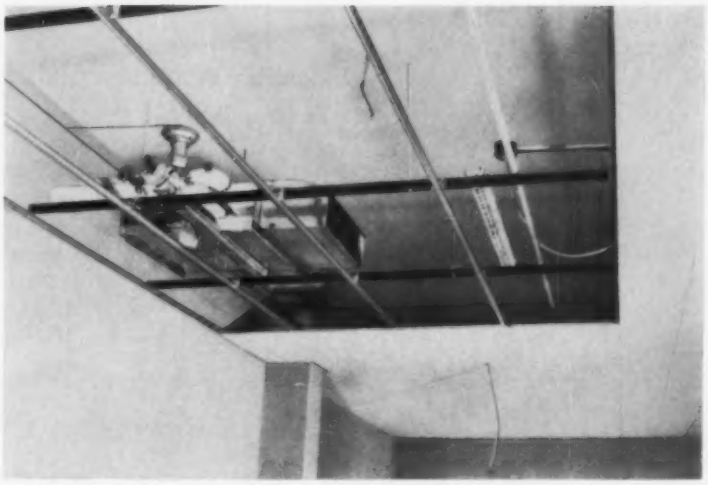
The air conditioning system for the four story, 220,000 sq ft structure allows air to enter a room at equal pressure through the small openings in the ceiling surface. Average air flow is 1.56 cfm per sq ft, representing a pressure of 0.005 in. of water gage.

Cool air originates from two 500 ton hermetic type centrifugal compressors. It enters a main corridor duct travelling at a rate of 900 fpm. A duct stub discharges air into a plenum space above the suspended ceilings in each room where an individual thermostat is located. The air which leaves the central cooling system at 58 F is warmed by booster heater coils in the stub duct before it passes down through the ceiling. Air is returned from the offices into the corridors, collected at return air grilles, brought back to the fans, and recirculated with 25 percent outside air.

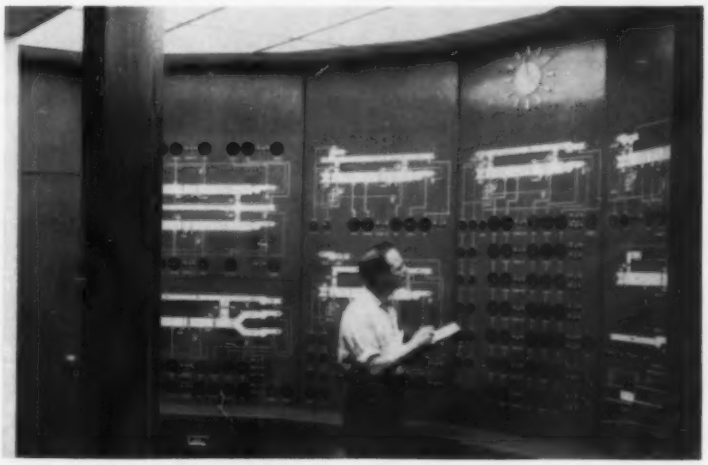
Heating is supplied by the booster heating coils until outside temperature reaches 40 F. Then the hot water heating system used in the building before installation of the new system goes into operation.

Eugene D. Scribner, a member of Armstrong's central engineering department, and the person credited with conceiving the perforated tile air diffusion system, feels that total winter heating is also possible if the air returns are strategically placed at floor level. This was not done in the design of the system because of the presence of the hot water system.

Mr. Scribner's ideas were presented to C. S. Leopold, Inc., Philadelphia consulting engineers, who incorporated the air diffusion concept into the system. B. & G. Olsen Co., Richmond, Va., was the air conditioning contractor.



STUB DUCT is equipped with a reheat coil which warms air before it is discharged into the plenum space above the perforated acoustical tile ceiling



DATA CONTROL PANEL enables one man to control temperature in each of the 19 separate air supply systems in the installation

Consulting Engineers Enter Joint Program with University

FRED S. DUBIN ASSOCIATES, consulting engineers, are conducting a cooperative program with the Quantitative Studies Department of Wesleyan University by offering on-the-job training to those students in the department.

An active contributor to architectural educational programs in many universities throughout the country, Fred S. Dubin has conducted many lectures and seminars in an effort to introduce to the students the engineering aspects of architecture.

you'll want to know

ASHRAE To Close Cleveland Lab

FUTURE RESEARCH conducted by the American Society of Heating, Refrigerating and Air-Conditioning Engineers will be done through an expanded grants-in-aid program to colleges and private laboratories. ASHRAE will close its Cleveland laboratory soon.

This action, voted upon at a recent meeting of the board of directors in Chicago, followed the recommendations of the Society's long range planning committee, which had studied the society's research activities.

Expects Construction To Rise in 1961

INDUSTRIAL CONSTRUCTION will enjoy an upswing in 1961, according to C. B. Wigton Jr., president of Wigton-Abbott Corp., engineers and constructors located in Plainfield, N.J.

Mr. Wigton, whose firm is a designer and builder of industrial research and production facilities, bases his prediction on the fact that a large number of companies, for which his firm has made preliminary studies in 1960, are now ready for construction.

He attributes the expected rise to a need of reducing costs of production by replacing old facilities and also an outlook of stable construction costs.

you'll want to know
...continued on page 181

Industry Group Meets in Cleveland To Formulate Heat Gain Calculation Method

A NEW heat gain calculation method for use by all segments of the industry drew a step nearer realization when members of the Industry Heat Gain Joint Study Group met in Cleveland recently to iron out the few remaining details prior to adoption of the plan.

More than a year of study and planning has gone into this project, which will eliminate the confusion caused by the existence of three different authoritative systems.

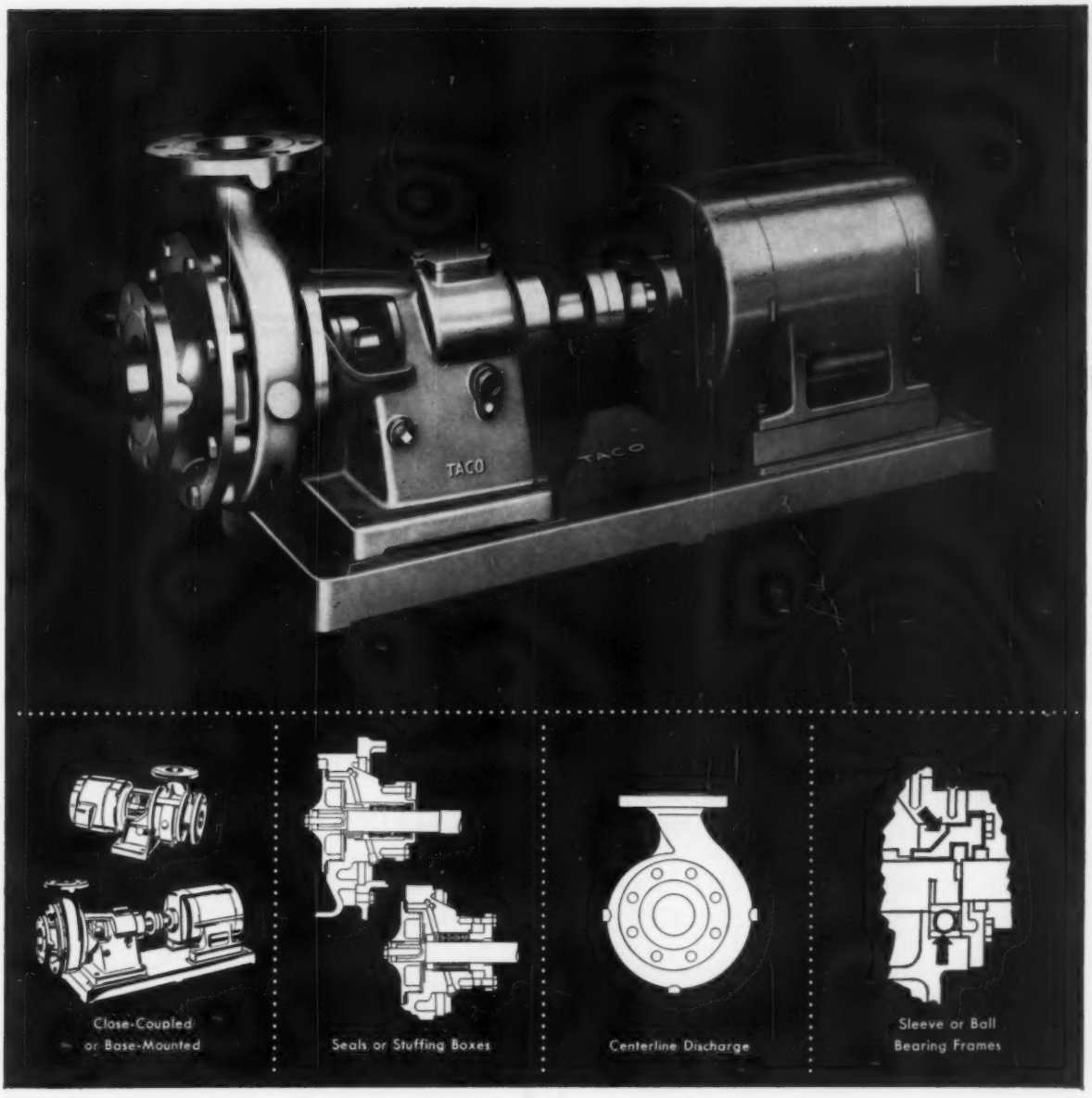
Currently in use are methods approved by the National Warm Air Heating and Air Conditioning Association, the Air Conditioning and Refrigeration Institute, and the Institute of Boiler and Radiator Manufacturers. Because the heat gain totals vary with each of the methods, the Federal Housing Administration asked NWAHACA's Technical Services Department to explore the possibility of developing a single method acceptable to all segments of the industry.

Joining hands to standardize such a method, the IBR, ARI, and NWAHACA appointed representatives to a 12-man committee to work on this project.

Reporting on the committee's progress, Herbert T. Gilkey, director of Technical Services for National Warm Air, said hundreds of man-hours had gone into this committee's work. "The knowledge and experience of every man working on this committee has been pooled for the common good of the industry, so, when the new method is finally approved, it will truly be an industry method," he said.

Early approval of the method is expected with the target date for publication set at May 1.

INDUSTRY HEAT GAIN JOINT STUDY GROUP members are (l to r) seated: Frederick J. Reed, Air Conditioning and Refrigeration Institute; Donald E. Perry, Carrier Air Conditioning Corp.; John I. Woodworth, Institute of Boiler and Radiator Manufacturers; Edward J. Brown and Warren S. Harris, Mechanical Engineering Department, University of Illinois. Standing are Herbert T. Gilkey, Director of Technical Services, National Warm Air Heating and Air Conditioning Association; Robert F. Smith, Assistant Director of Technical Services, NWAHACA; Woody Radle, Chrysler Airtemp, Div. of Chrysler Corp.; Richard Martin, ARI; Fred McGhan, Architectural Standards Div., Federal Housing Administration; G. R. Munger, Owens-Corning Fiberglas Corp.; and Donald J. Vild, Libby-Owens-Ford Glass Co.



How to please everybody . . . well almost!

It's a cinch you can't please *all* users of centrifugal pumps with *any* single line of pumps. But the TACO "LP" does give an awful lot of heating engineers precisely the pump performance they need.

The reason is *extras* . . . extra design features which make an "LP" more versatile, more efficient, more dependable. For example, it's available close-coupled or base-mounted . . . with sleeve or ball bearing frame . . . extra quiet motor . . . mechanical seals or stuffing boxes. It's an *advanced-design* pump too . . . with self-venting centerline discharge . . . casings adaptable to horizontal discharge. And . . . it's a *top quality* pump . . . with stainless steel shaft sleeves . . . oil slinger lubrication . . . permanently located throttle bushing.

For *your* next installation, pick your pump from the line with the extras . . . "LP". TACO also manufactures a line of high head pumps and circulators. Write TACO HEATERS, INCORPORATED, 1160 Cranston St., Cranston 9, Rhode Island.

TACO

SERVING THE HYDRONIC INDUSTRY SINCE 1920

In pneumatic damper motors, Honeywell EXTRA SENSITIVITY!

Feature by feature, you'll find more advantages by far in this damper motor. The MP903 is especially designed to operate air valves and shutters in high velocity mixing boxes and other damper applications.

It's smoother because the "Zytel" nylon bearing and the cadmium-plated motor shaft provide a low-friction surface that eliminates erratic operation. *It's more sensitive* because the Neoprene diaphragm flexes more quickly, prevents sluggishness. *It's more rugged* because the air chamber is fabricated by high-impact extrusion. *It's more trouble-free* because all materials are tested for dependable performance and long wear under all conditions.

The Honeywell MP903 Pneumatic Piston Motor provides all the built-in design and performance advantages you need to insure the finest damper application for every job. For further information, call your local Honeywell office. Or write Minneapolis-Honeywell, Dept. AC-2-51, Minneapolis 8, Minnesota.

CLOCK THE DIFFERENCE

A thinner diaphragm, low reversal

The durable molded Neoprene rolling-type diaphragm flexes quickly and easily so that there's no sluggishness in the reaction of the motor to calls from the thermostat. Assures full power throughout motor stroke. "Bead seal" eliminates leakage.

COMPARE THESE SPECIFICATIONS

DAMPER LOAD RATINGS:
MP903A—17 sq. feet } Based on
MP904A—60 sq. feet } face velocities
MP903B—13 sq. feet } up to
MP904B—50 sq. feet } 1,000 FPM

STANDARD CASE DIMENSIONS:
MP903—3¾" diameter, 6 1/16" long.
MP904—6¼" diameter, 6 15/16" long.

CONSTRUCTION:
Rolling-diaphragm-operated piston motors especially designed to provide high force output and long, trouble-free service. Universal mounting bracket included.

ACTION:
Piston moves to extend shaft as the branch line air pressure increases. Action reverses upon pressure decrease.

CONTROL AIR PRESSURE:
0-15 psi.

STROKE:
All models factory set at full 3½" travel. Easy to readjust to needs of individual installations.

STROKE LIMITING ADJUSTMENT:
Stroke may be adjusted from 3½" maximum down to 2¼" minimum.
NOTE: Adjusting motor stroke also changes motor range and motor start (and/or finish) point.

OPERATING TEMPERATURE RANGE:
—20° F. to 160° F.

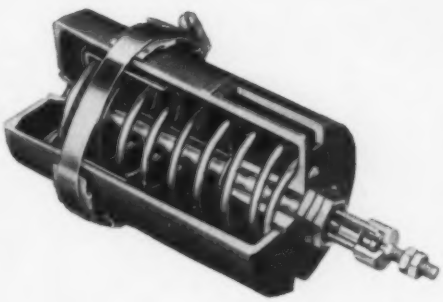
quality makes the difference

GREATER SMOOTHNESS!

FEEL THE DIFFERENCE

Low-friction cadmium plating

The smooth, low-friction surfaces of the cadmium-plated motor shaft and the "Zytel" nylon bearing eliminate any seizing of the shaft itself. The motor spring is also heavy-duty, oil-tempered cadmium-plated steel to assure long, corrosion-free life.



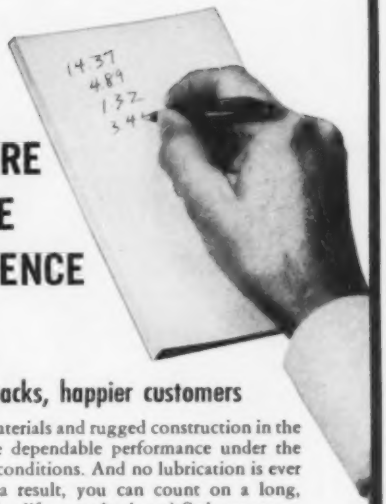


FIGURE THE DIFFERENCE

Fewer callbacks, happier customers

The quality materials and rugged construction in the MP903 assure dependable performance under the most adverse conditions. And no lubrication is ever required. As a result, you can count on a long, maintenance-free life, completely satisfied customers.

Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

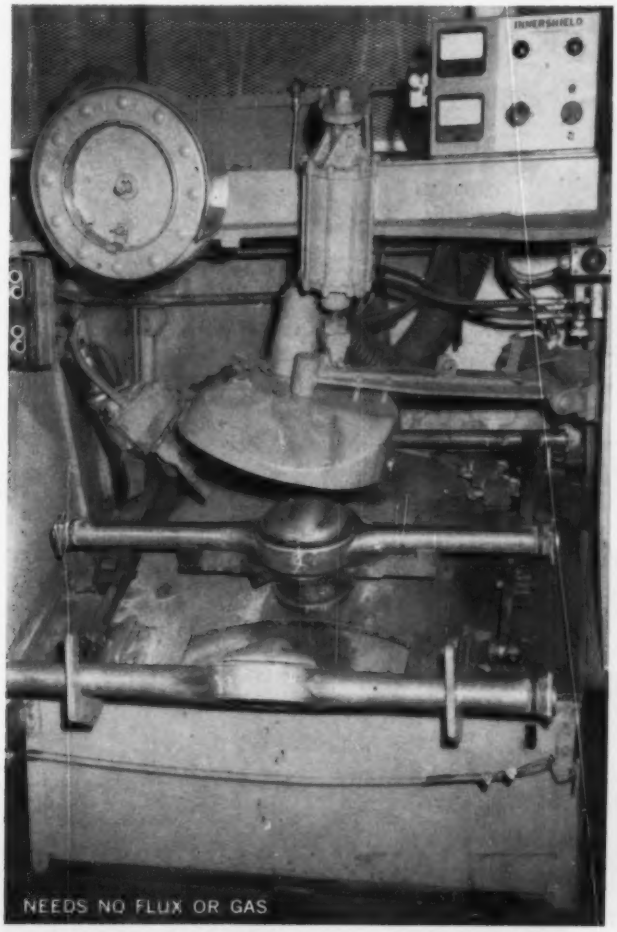
It's what's inside that counts

NEW TUBULAR ELECTRODE

Now quality automatic welds can be made without CO_2, Argon or granular flux. Photo magnifies electrode 3½ times.

NEEDS NO FLUX OR GAS

LINCOLN'S dramatic new welding process—INNERSHIELD—uses a special tubular electrode containing all necessary ingredients—filler metal, arc shielding, deoxidizers, fluxes. Two new welders use it—a full automatic and a semi-automatic.



This is Lincoln's Innershield at work . . . full-automatic. No other automatic process even comes close to the speed. You press the button to weld and really lay down a bead fast . . . over 300 inches per minute on light gage lap or butt welds. The dust cap and flanges of this axle housing demonstrate how Innershield really goes to work—they are welded 60% faster with Innershield than with the previous process.

This is Lincoln's Innershield Squirt . . . on the job. It's ideal for high-speed, single-pass welding on light metal parts like these building trusses. Deposition efficiency is high, since the electrode is a continuous 50-pound coil. In this operation, Innershield increased welding speed 30%. That's not all: because this automatic electrode contains *ALL* the welding ingredients, purchasing, inventory and storage are simplified.

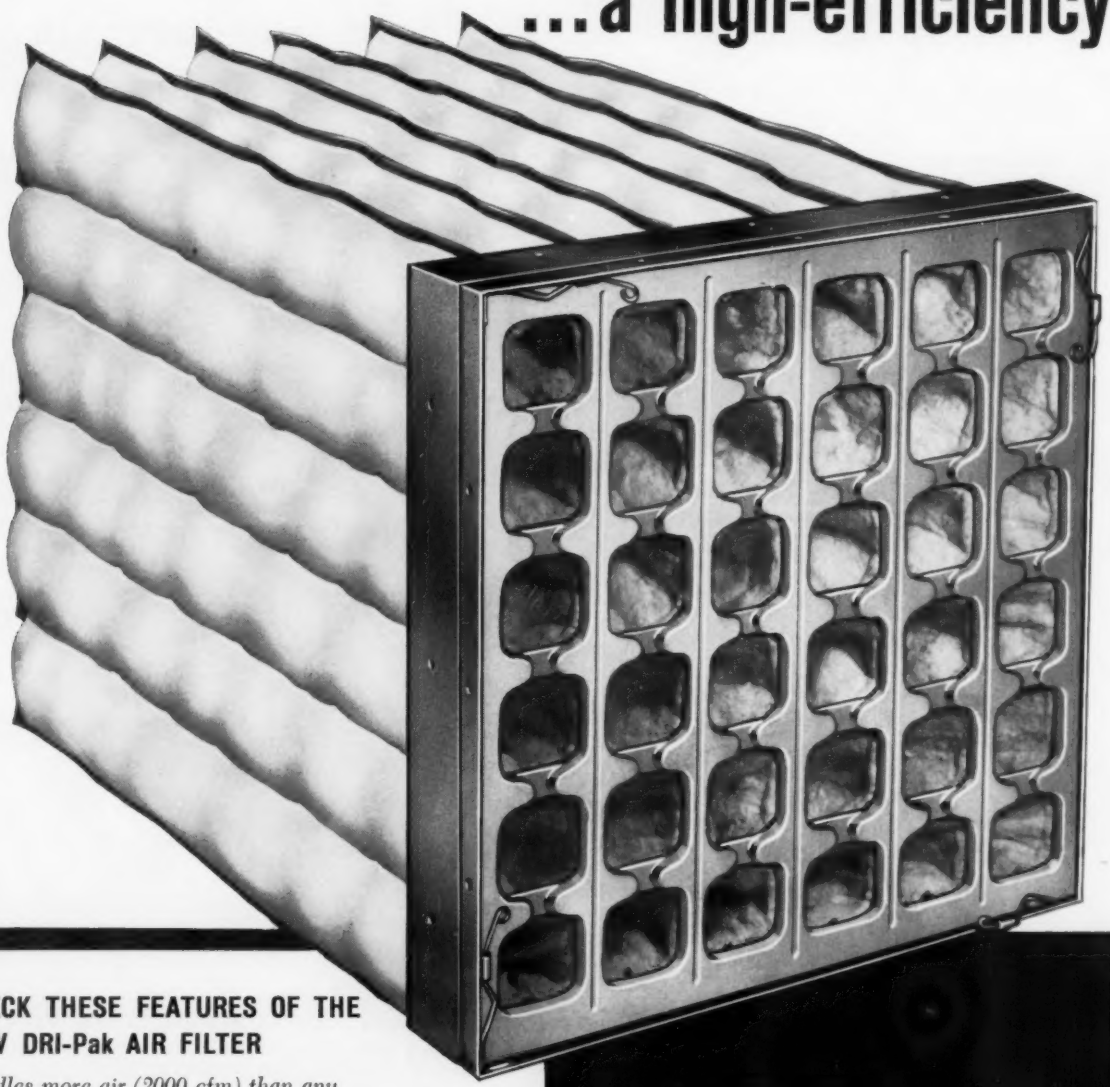
Here's the inside story . . . how the cost-cutting, profit-producing advantages of Innershield can go to work for you. A new bulletin, hot off the press, covers the dramatic story of the new tubular electrode and how it works. It also describes in detail both the full and semi-automatic Innershield welders now available. Write for your copy of bulletin 5300.1 today. The Lincoln Electric Company, Dept. 3921, Cleveland 17, Ohio.

LINCOLN WELDERS

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT AND ELECTRODES

NEW! DRI-*Pak* SERIES 2000

...a high-efficiency



CHECK THESE FEATURES OF THE NEW DRI-Pak AIR FILTER

- *Handles more air (2000 cfm) than any similar unit!*
- *Unique holding frame (only 4" deep) permits servicing from either air-entering or air-leaving side of bank.*
- *Rated at 95% efficiency! (National Bureau of Standards Dust Spot or AFI Method on Atmospheric Dust.) Models rated at 85% and 55% also available.*
- *Compact, collapsible cartridge weighs just 4 pounds, requires little storage space, makes handling and servicing simple and easy.*

95 sq. ft. of filtering media in one unit!.....

unit filter from AAF!

New dry-type unit offers unmatched combination of air filter advantages. AAF's new DRI-Pak Series 2000 air filter combines high efficiency, low resistance, compactness and large dust-holding capacity to a degree unequalled by any other dry-type unit filter.

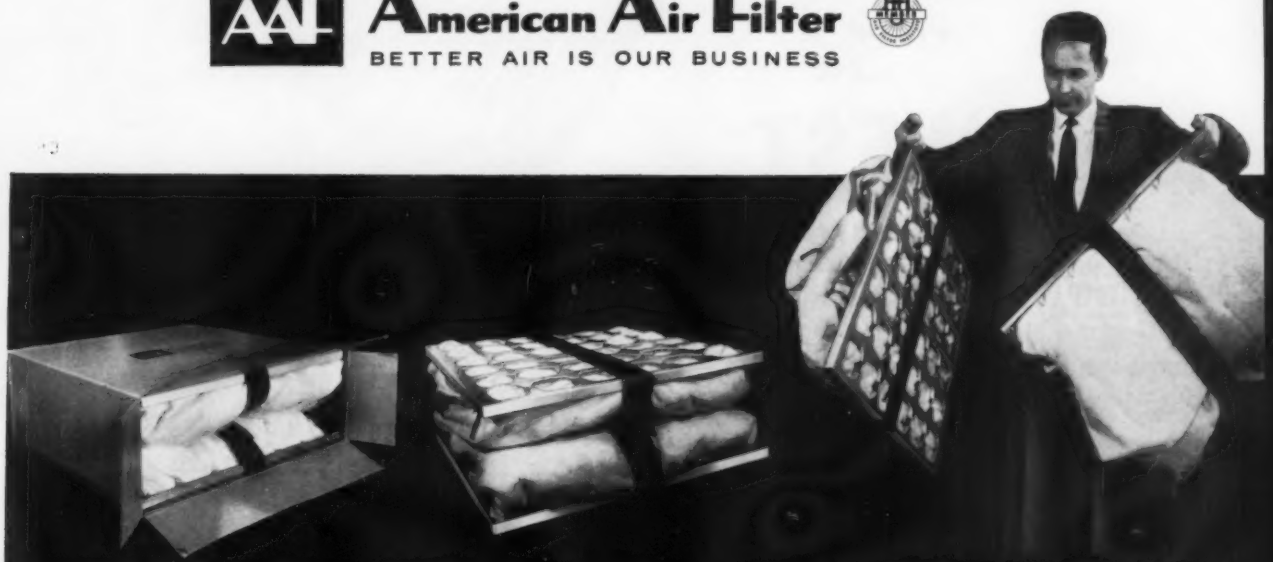
The secret is in its unique "windsock" operation. The "tubes" of the glass fiber media inflate to a 36-inch depth when the system is in operation, but collapse when the system is shut down! This collapsing feature eliminates the need for rigid back-up wire grid and the possibility of damage to the cartridge during servicing.

Filter maintenance amounts to nothing more than infrequent replacement of the DRI-Pak cartridge. And the plenum for a bank of DRI-Pak filters need be very little deeper than the filter's 36-inch inflated depth because almost the total space can be used as access to washer, coils, etc., when the system is shut down. The AAF DRI-Pak is available is 24″ x 24″ or 12″ x 24″ sizes.

For complete product information on the new DRI-Pak air filter, call your local AAF representative or write us direct for Bulletin No. 228. Address: Mr. Robert Moore, American Air Filter Company, Inc., 373 Central Avenue, Louisville, Kentucky.

AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

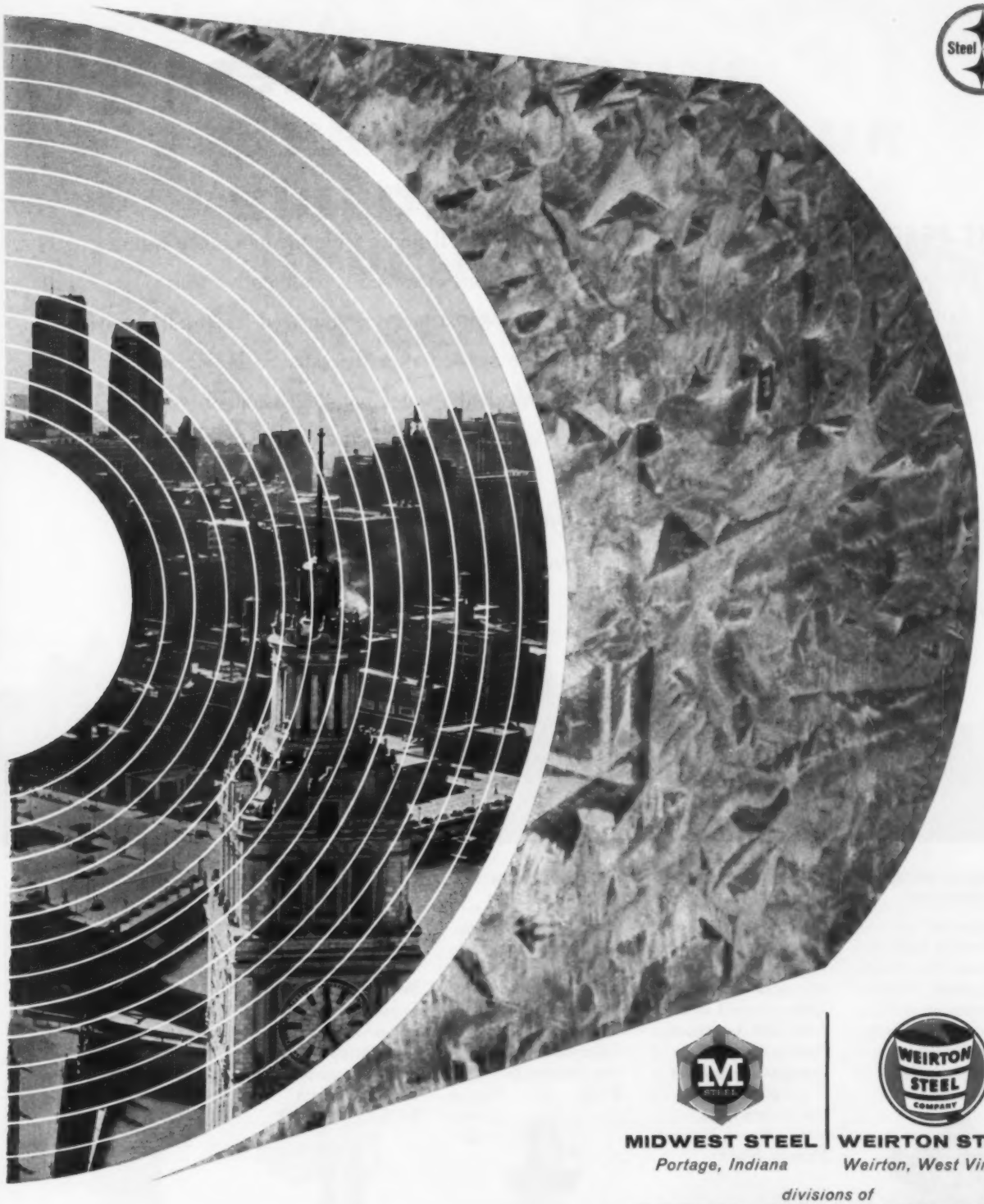


8-inch-deep carton...holds two filters...each weighing just 4 lbs.!

NOW
MORE
GALVANIZED
STEEL
FOR
MID-AMERICA
FROM
NEW

MIDWEST STEEL

For one of the greatest steel-consuming areas of the country, galvanized steel will now be in greater supply. The source is close, the service is fast, and the quality is second to none. Because



MIDWEST STEEL
Portage, Indiana

WEIRTON STEEL
Weirton, West Virginia

divisions of
NATIONAL STEEL CORPORATION

Weirkote, the modern continuous-process galvanized steel, is now being produced at our new Midwest Steel facilities in the Chicago area, as well as at our Weirton Steel division in the Pittsburgh area.

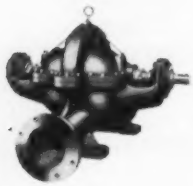
SOLVE THESE 10

MAKE PEERLESS YOUR ONE CALL SOURCE. You'll find a wide model choice within each type of pump. You'll get quick, courteous help from a trained representative who understands your installation. You'll get good technical assistance if you need it. You'll receive good delivery service, and equally important back-up service after the sale. So be job wise. Specify, buy and install a quality Peerless Pump for all the water handling needs in your building. To obtain bulletins listed below, write Peerless Pump, Hydrodynamics Division, Food Machinery and Chemical Corporation, 301 West Avenue 26, Los Angeles 31, California or 2005 Northwestern Avenue, Indianapolis 8, Indiana.

PEERLESS PUMP, HYDRODYNAMICS DIVISION
Los Angeles 31, Calif. and Indianapolis 8, Ind.
Putting Ideas to Work

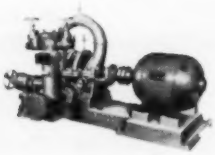
CHILLED WATER HANDLING

The horizontal split case Peerless **Type A** is ideal for this service. Easy to install. Widest application possibilities in water pumping. Request Bulletin B-1300.



FIRE PREVENTION SYSTEMS

Select from vertical or horizontal models. All Peerless **Fire Pumps** are approved by Underwriters Laboratories and Associated Factory Mutual Fire Insurance Companies. A complete package line. Outstanding service record. Request Bulletin B-1500.



CONDENSER CIRCULATION

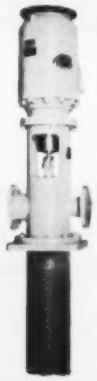
Close-coupled **Hydro-Foil** pumps can be installed for wet or dry pit application. Extremely adaptable where space is limited. Full range of capacities. Request Bulletin B-148.

COOLING TOWER SYSTEMS

Highly flexible, the Peerless lineup of **Vertical Industrial Service** pumps are extremely efficient, require little maintenance. Install them inside or outside. Request Bulletin B-505.

HEATER DRAIN, CONDENSATE RETURN

Peerless **Hydro-Line**® pump handles fluids with temperatures up to 400°F. Designed for operation with any available NPSH. Compact. Takes minimum space. Request Bulletin B-1700.

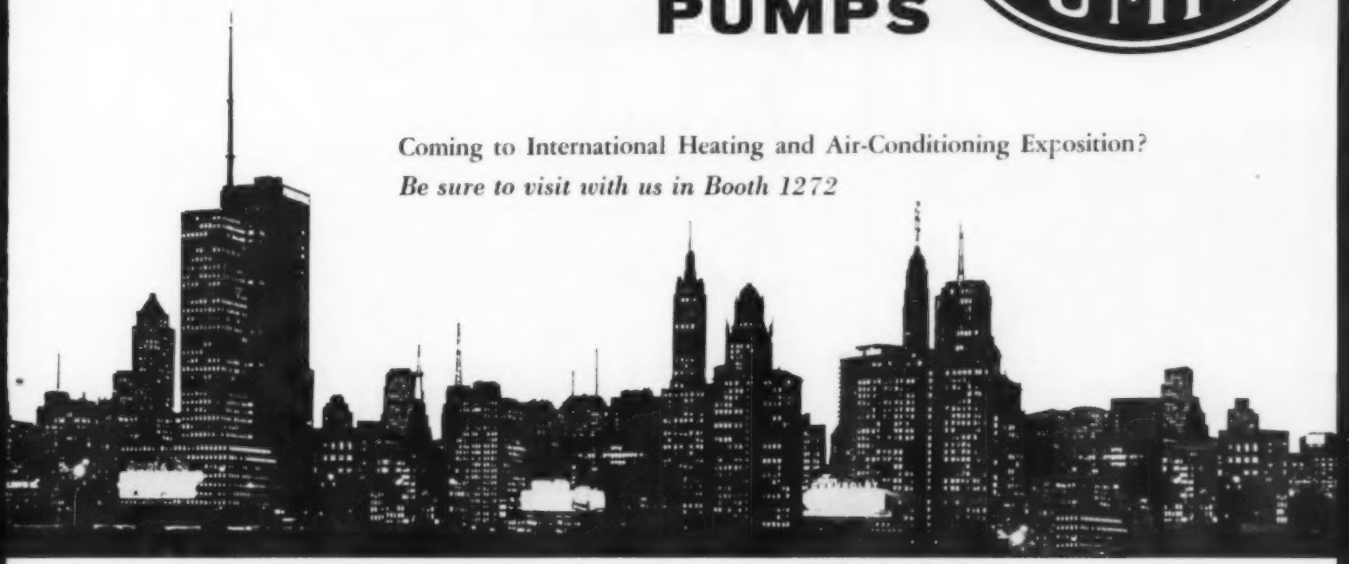


HORIZONTAL
VERTICAL

KEY WATER HANDLING PROBLEMS IN YOUR BUILDING WITH DEPENDABLE PEERLESS PUMPS

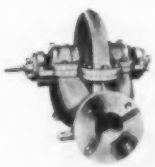
PEERLESS PUMPS

Coming to International Heating and Air-Conditioning Exposition?
Be sure to visit with us in Booth 1272



ZONE PUMPS

A highly versatile pump, the **AquaLine**® is an economical split-case side suction model. Can be applied equally well in many different pumping applications. Request Bulletin B-2100.



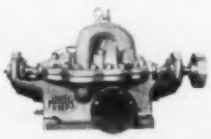
HOUSE SERVICE PUMPS

Apply these end-suction centrifugal **Fluidyne**® pumps in any number of uses. Economical. Models in all desired sizes. Request Bulletin B-2300.

NEW VERTICAL AQUALINE It's quieter. Extremely compact. Has high efficiency record. Fits many pumping needs. Economical in price. See it on display for the first time at the Peerless booth during the exposition in Chicago.

BOOSTER PUMPS

These Peerless **TU and TUT** pumps fill an important need in today's modern building. Internal or loop crossover in these multi-stage pumps allows development of high head and capacity from a compact unit. Request Bulletin B-1400.



HYDRONICS SYSTEMS

A proven-in-use series of pumps, the Peerless **DM and DMR** pumps are ideal for handling superheated water. Volutes, impellers and backplates readily adapted to tailor pump to exact requirements. Request Bulletins B-1608 and B-1610.

WATER SUPPLY

Uusurpassed record of performance in lifting water from source wells. The Peerless **Vertical Turbine** pump has wide range of capacities, setting depths to handle any need you may have. Request Bulletin B-141.

Freon-13®
for low low temperatures

Another premium Du Pont refrigerant now available from your refrigeration wholesaler

Ultralow-temperature refrigeration —this is the ever-increasing role being performed by Du Pont Freon-13*. And now Du Pont has met industry's growing need for this refrigerant by making it commercially available from your refrigeration wholesaler.

Use of "Freon-13" with "Freon-12" or "Freon-22" in two-stage cascade systems has made practical the attainment of ultralow-temperature conditions of −100°F. and lower.

Cascade systems with "Freon-13" are already operating successfully for such applications as metal treating, shrink-fitting of parts, oxygen manufacturing, environmental testing and low-temperature storage and preservation.

In common with all "Freon" refrigerants, "Freon-13" has excellent thermal and chemical stability—is nonflammable, virtually nontoxic and unsurpassed in purity and dryness. Ask your local, dependable refrigeration wholesaler for it.

For more information write: E. I. du Pont de Nemours & Co. (Inc.), "Freon" Products Division, N2420, Wilmington 98, Delaware.

FREON®
premium quality
refrigerants

DU PONT
REG. U.S. PAT. OFF.

**Freon- and F- followed by numerals are Du Pont's registered trademarks for its fluorocarbon refrigerants.*

Better Things for Better Living . . . *through Chemistry*

McQuay

air·conditioning equipment

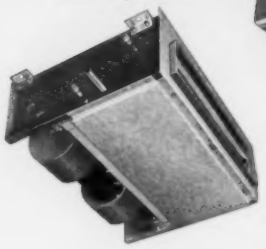
Including the
New Single and
Multi-Zone
Air Handling
SEASONMASTERS

McQuay Means Quality

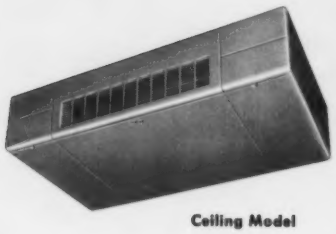
McQuay

SEASONMAKERS

McQuay offers the finest in remote type, individual room air conditioners for use with a central station heating and cooling system. Extremely quiet, the "Seasonmaker" is available in floor, basic, ceiling and hideaway models in a wide range of sizes to meet your exact requirements. Floor and basic models range from 220 to 1240 cfm, and ceiling and hideaway models range from 220 to 640 cfm. Write for catalog 715.

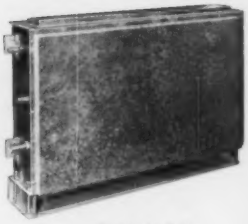


Hideaway Model

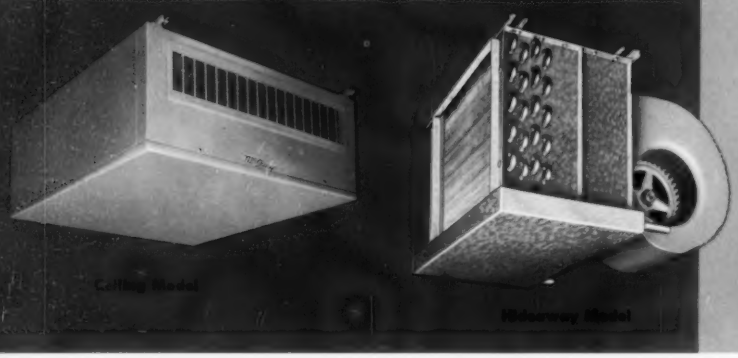


Ceiling Model

Floor Model



Basic Model



Ceiling Model

Hideaway Model

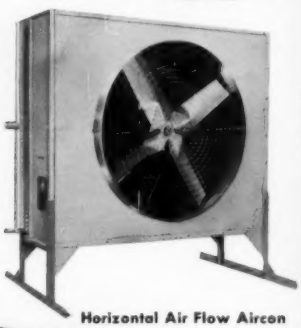
LARGE CAPACITY SEASONMAKERS

2 TO 10 TONS CAPACITY

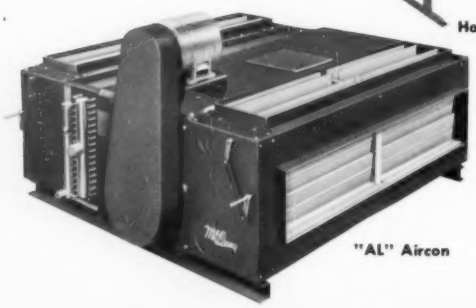
Remote type ceiling suspended air conditioners for medium to large areas. Designed for fully recessed closet and false ceiling installations, or horizontally suspended in the conditioned space. The quiet, attractively styled McQuay large capacity "Seasonmaker" is available in four sizes of direct drive and five belt driven models. Write for catalogs 722 and 730.

McQuay

Vertical Air Flow Aircon



Horizontal Air Flow Aircon



"AL" Aircon

REMOTE TYPE AIR COOLED CONDENSERS

"AB" AIRCONS—Propeller fan types available in either horizontal or vertical air flow. Thirteen sizes each from 8 to 85 tons nominal capacity. Multiple installations make capacity unlimited. Write for catalog 629.

"AL" AIRCONS—Centrifugal fan types are designed for outdoor or indoor installations with or without duct work. They may also be used for exhaust ventilation and heating. Compactly engineered with a low silhouette, there is a wide range of unit and fan discharge arrangements. Write for catalog 635.

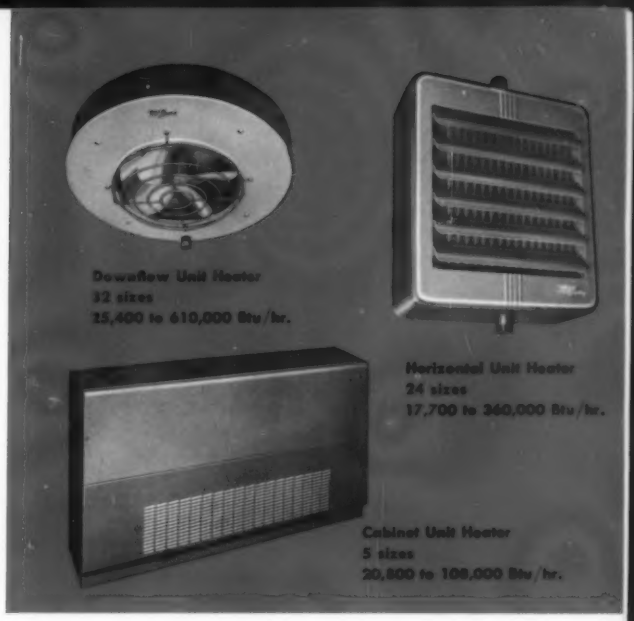
AUTOMATIC HEAD PRESSURE CONTROL

The McQuay type "AB" and "AL" Aircons are available with air side and refrigerant side head pressure control. The "AB" line is offered with opposed blade face dampers and corresponding controls for automatic operation.

McQuay

UNIT HEATERS

Horizontal, downflow and cabinet type unit heaters are available in an exceptionally wide range of sizes and capacities for either steam or hot water. Adjustable louvers and several varied styles of air deflectors are available. McQuay cabinet type unit heaters are available for floor, wall and ceiling applications; for exposed, semi-recessed or fully recessed installations. Write for horizontal unit heater catalog 323, downflow unit heater catalog 765, cabinet unit heater catalog 351.



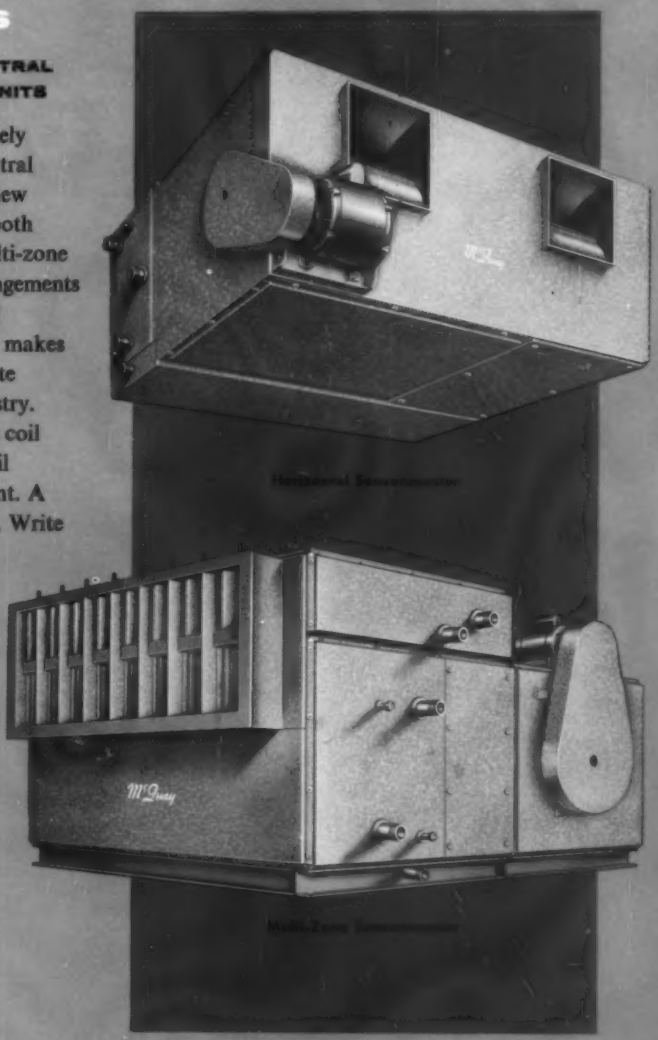
McQuay

SEASONMASTERS

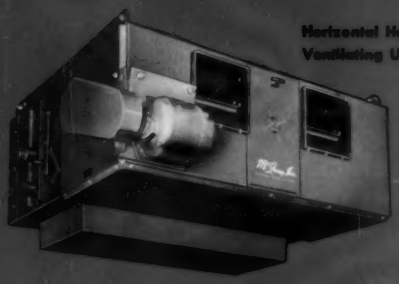
SINGLE AND MULTI-ZONE CENTRAL STATION AIR CONDITIONING UNITS

McQuay proudly offers a completely new line of quality engineered central station air conditioning units. A new space saving design, available in both single zone draw through and multi-zone or double duct blow through arrangements in low pressure (up to 3" s.p.) and medium pressure (3" to 5½" s.p.), makes the McQuay line the most complete and versatile throughout the industry. Twenty-four models with multiple coil sizes insure the proper fan and coil combinations for every requirement. A full line of accessories is available. Write for catalog 560.

Vertical Seasonmaster



McQuay



Horizontal Heating and Ventilating Unit

Vertical Heating and Ventilating Unit

"HC" HEATING AND VENTILATING UNITS

For heating and ventilating, McQuay offers the most flexible line available anywhere. Designed for horizontal, vertical, wall and inverted installations for use with or without duct work to fill the needs of every installation. For use with hot water or steam, the McQuay line offers the widest range of coil selection in the industry, with capacities ranging up to 48,000 cfm and 3,320,000 Btu/hr. Write for catalog 344.

McQuay

SEASONVENT

The McQuay Seasonvent is a deluxe large capacity heating and ventilating unit engineered specifically for school auditoriums, theatres and similar installations where quiet operation is a necessity. The Seasonvent is extremely versatile with nine sizes for low static applications (0" to 1¼" s.p.) and seven sizes for high static installations (1" to 2" s.p.), with capacities from 1250 to 15,000 cfm. Write for catalog 575.

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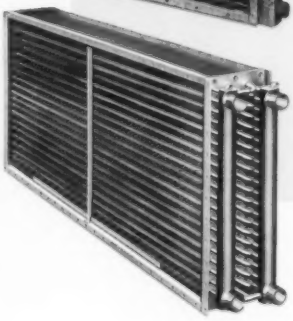
RIPPLE-FIN COILS

By the Nation's Largest Coil Manufacturer

A new type "5" coil design with a wide range of available fin spacings offers unlimited selection to meet all load requirements. This new design affords a new high in fin efficiency by attaining the highest heat transfer rate possible without excessive air friction. The combination of equilaterally staggered tubes and modified rippled fins produces maximum air turbulence, and intimate and prolonged contact between air and heat exchanger surface.

Direct expansion coils with pressure type distributors.

Pitched in casing steam coils. Easy installation and positive condensate draining.



Flow circuited water cooling and heating coils.

McQUAY, INC., 1600 Broadway N.E., Minneapolis 13, Minnesota

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AIR CONDITIONING • HEATING • REFRIGERATION

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HOSPITAL ZONE

for whisper-quiet air conditioning or heating service

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New 1750K

Ingersoll-Rand MOTORPUMP

Here is a pump that gives you extremely quiet operation without a sacrifice in efficiency and still has all the proven features of other Ingersoll-Rand high speed, high efficiency Motorpumps!

These packaged units with non-overloading motors are available in ¾ through 7½ horsepower sizes for deliveries to 500 gallons per minute and heads to 110 feet. Select a pump to suit your conditions, take it off-the-shelf, hook it up and you're ready to go. Other high speed "K" line Motorpumps are available through 25 horsepower.

Check these ruggedly constructed "K" line Motorpumps in either 1750 or 3450 rpm speed. Note their features and see why they deliver continuous, trouble-free service. You will save time and trouble by using "K" line Motorpumps.

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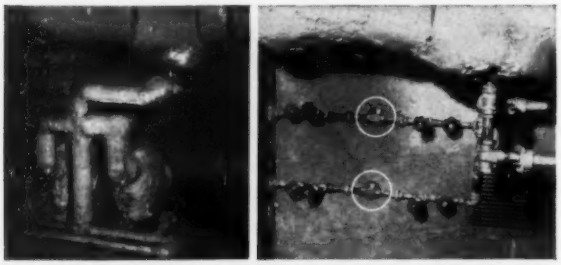
Write for complete data on all Ingersoll-Rand pumps for air conditioning service . . . the complete Motorpump line, cradle-mounted pumps and horizontally-split pumps.

SARCO TOPICS

How Major New York office building solved steam trapping problems through trap standardization

Recently, the Office Building at 625 Madison Avenue, New York, — erected in 1931 and comprising 420,000 square feet on 17 floors — discontinued its own steam generation and switched to district steam. The changeover made the inadequacies of old bucket and float traps more apparent than ever, and afforded an occasion to modernize trapping. Here's how major improvements were made.

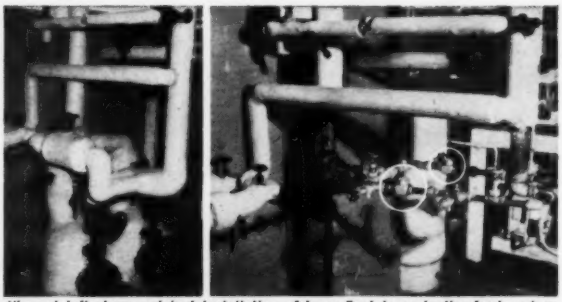
The first problem was maintenance. All maintenance had to be done at night or on weekends, at overtime rates, because the system could not be shut down during business hours. Frequent breakdowns added to maintenance costs. After the installation of Sarco Thermo-Dynamic Steam Traps, Type TD-50, trap maintenance — and therefore maintenance costs — have been reduced almost to zero. The engine room crew are now free for other jobs, and savings in both regular and overtime manhours are considerable.



Left picture shows the steam service main from the street, with massive float trap installation. Picture at the right is view of installation after the changeover to TD-50's (circled).

The second problem was water-hammer, caused by passage of live steam into return lines when traps failed open. (When traps failed closed, water accumulated in steam supply mains and equipment.) Installation of TD-50 steam traps ended waterhammer and consequent damage to equipment, because the TD-50 discharges condensate as rapidly as it is formed and prevents steam from entering the return system.

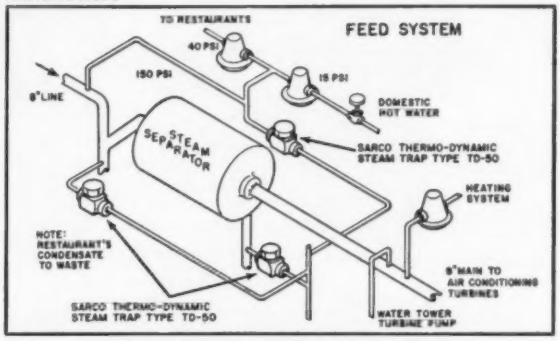
The third problem was live steam loss. Live steam, discharged into the return lines, not only represented a great waste of heat energy, but caused waterhammer in the return, and raised the condensate temperature to an excessive level. (Incidentally, although the building's district steam system is, of course, not faced with this problem, hot condensate passing through condensate pumps can damage pump seals.) These problems are eliminated through the use of TD-50's. No steam can be blown into the return main because the TD-50 shuts off *positively*, blocking any possibility of live steam being discharged into the return. Savings are considerable.



View at left shows original installation of huge float traps in the feed system of the building. View at the right shows compact installation of Sarco TD-50 Steam Traps (circled).

These benefits were achieved by replacing bucket and float traps with Sarco Thermo-Dynamic Steam Traps, Type TD-50, matched and correctly sized to the application. For example, many ½" bucket traps were replaced with ⅜" TD-50's, which have ample capacity for the job.

The TD-50's pressure range of 10-600 psi made it possible to standardize on one steam trap for a variety of applications that formerly required traps of many different types and pressure ratings. Finally, changeover took only 30 minutes per trap for each compact TD-50 installation.



Schematic hook-up of the converted feed system.

The success of this TD-50 installation led Collins, Tuttle Co., Inc., managers of the building, to substitute Sarco Thermo-Dynamic Steam Traps for competitive bucket traps in two other major New York buildings.

For more information on Sarco Thermo-Dynamic Steam Traps, contact your Sarco Sales Representative or district office, or write.

2165

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.
STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

No. 2 in a series for your SPEC. FILE†

Suggested specifications for insulating OUTDOOR HEATED and CHILLED PIPING with G-B SNAP*ON® Glass Fiber PIPE INSULATION

DESCRIPTION

Versatility is the keynote to G-B Snap•On, the one-piece hinged pipe insulation molded entirely of fine glass fibers. Possessing all the characteristics of glass itself, G-B Snap•On will not deteriorate or lose its outstanding thermal efficiency even when exposed to extremely contrasting weather conditions. Available in a wide variety of weather-proof jackets, G-B Snap•On is your best insulation buy for chilled or heated piping to 350° F. temperatures. Lightweight and easy to handle and apply, G-B Snap•On provides positive insulation protection for the life of the installation.

MATERIAL SPECIFICATIONS

PLUMBING—thermal insulation for COLD WATER PIPING—ABOVE 50°

Insulating Material—All cold water service piping shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one-piece molded sections ...." thick. Piping shall be clean and dry and shall be tested before insulation is applied.

AIR CONDITIONING & DUAL TEMPERATURE PIPING — thermal insulation for chilled water or combination hot and chilled water supply and return piping below 50° or up to 212° F.

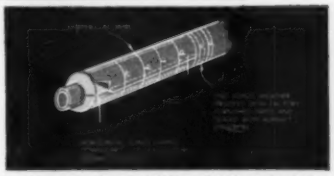
Insulating Material—All chilled water or dual temperature heating and cooling lines to air conditioning equipment and return shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one piece molded sections ...." thick with factory-applied vapor barrier jacket. Piping shall be clean and dry and shall be tested before insulation is applied.

HEATED PIPING—thermal insulation for low pressure steam or hot water supply and return piping up to 350° F.

Insulating Material—All low pressure steam or hot water supply and return piping used for heating, located indoors in unconditioned areas or where touch-temperature insulation is required, shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one piece molded sections ...." thick. Piping shall be clean and dry and shall be tested before insulation is applied.

APPLICATION SPECIFICATIONS

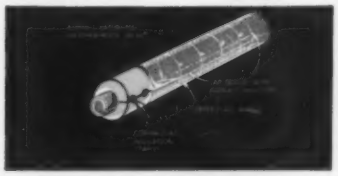
INSULATION OF OUTDOOR PIPING . . . WEATHERPROOF JACKET FACTORY APPLIED



The insulation shall be applied to the pipe with end joints tightly butted. The longitudinal seam shall be tightly closed and the insulation held to the pipe with separate loops of copper-clad wire on 4" centers.

End joints shall be weatherproofed with factory-furnished 4" wide strips of jacket material held in place with two separate loops of copper-clad wire and sealed, if specified, with asphalt emulsion. Longitudinal laps shall be placed at the side of the pipe facing downward, to shed water and sealed with asphalt emulsion if specified.

INSULATION OF OUTDOOR PIPING . . . WEATHERPROOF JACKET FIELD APPLIED



The insulation shall be applied to the pipe with end joints tightly butted and the longitudinal seam firmly closed with suitable copper-clad wire or insulation staples; four wire loops or staples per 3' of section length.

An asphalt saturated and coated weatherproofing jacket weighing not less than 35 lbs. per 100 sq. ft. shall be applied over the insulation with 3" laps at longitudinal and end joints, the laps sealed with asphalt emulsion when specified. The horizontal laps shall be made downward to shed water. The weatherproof jacket shall be tightly wrapped and held securely in place with separate loops of copper-clad wire spaced on 4" centers.

(CUT ALONG THIS LINE)

RECOMMENDED JACKETS FOR G-B SNAP* ON PIPE INSULATION FOR OUTDOOR PIPING

Ordering Name	Description	Sec. Length	Vapor Barrier	Where To Use
Weatherproof Roofing Jacket	A felt base, saturated and coated with asphalt. Available in standard weight: 35-lb., or for additional protection, 45 lb. or 55 lb. weights are available, all factory applied with a 2" longitudinal flap and 4" tapes for sealing end joints.	3'	No	On exterior lines requiring weather protection. Where a vapor barrier is required, a suitable jacket should be ordered factory applied with weatherproof roofing, aluminum, or other suitable material applied in the field over the vapor barrier.

†Complete series of G-B Snap•On specifications will appear in this publication in the coming months. Each will be designed to be clipped from the publication and placed in your spec. file. However, if you would like to have all G-B Snap•On specifications at this time, simply write:

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON®

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Thermal and acoustical glass fiber insulations . . . Molded glass fiber pipe insulation . . . Couplings and fittings for plain and grooved end pipe

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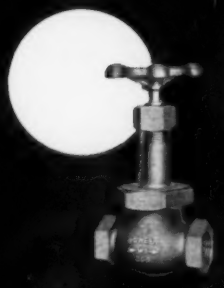
Powell manufactures valves in most metals ... in many designs ... for many temperatures and pressure requirements. And Powell maintains large factory and distributor stocks, so orders for regular valves can be filled promptly, thereby preventing costly operational delays or shut downs.

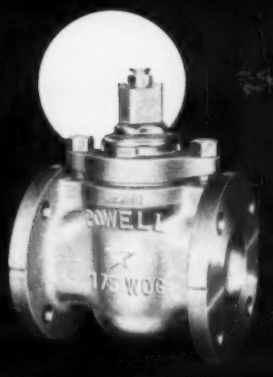
One quick call to the Powell valve distributor in the major city nearest you or to The Wm. Powell Company will fill your valve needs. And Powell with 115 years of industrial valve manufacturing know-how will also solve your flow control problems.

200-pound Bronze Gate Valve, union bonnet, inside screw rising stem, renewable nickel-bronze disc—Fig. 375. Sizes ¼" through 3". Also available with flanged ends, sizes ¾" through 3".

125-pound Iron Body Bronze Mounted Gate Valve. Outside screw rising stem and yoke. Flanged Ends—Fig. 1793. Sizes, 2" through 30". Also furnished in All Iron.



200-pound Bronze "W.S." Globe Valve—Fig. 2608. Exclusive Powell features make possible maximum flow with minimum pressure drop and turbulence. 500 Brinell stainless steel disc and seat. Sizes ½" to 3".



175-pound W.O.G. Semi-Steel Lubricated Plug Valve. Wrench operated. Fig. 2201—flanged end, sizes 1" through 4". Also available with screwed ends.

115th year of manufacturing industrial valves for the free world

POWELL PRECISION VALVES

THE WM. POWELL COMPANY CINCINNATI 22, OHIO

CLOGGING by high wet-strength paper products is IMPOSSIBLE!

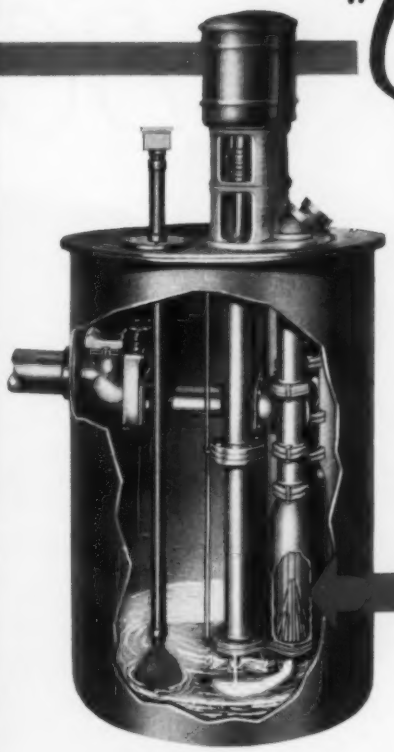
with the new FLUSH KLEEN® system from "Chicago"

This clogging cannot happen with the FLUSH KLEEN System

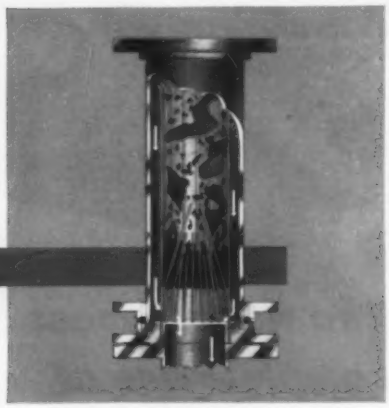
CLOGGED— Paper toweling piled up at eye of 2½" sphere design impeller.

CLOGGED— Complete clogging of 2½" sphere design impeller.

CLOGGED— Complete clogging of 3" sphere non-clog impeller.



THE FLO-THRU STRAINER, heart of the Flush Kleen system continuously permits only clear liquid to flow through the strainer into the pump at highest solids loadings.



SOLIDS NEVER REACH THE IMPELLER

Impeller handles only clear liquid. Shaft, bearings and motor are never subjected to severe strain and wear due to partially or completely clogged impellers. The life of a Flush Kleen system is therefore much longer than that of so-called non-clog type pumps. "Down time" due to clogging is eliminated and a quiet, smooth operating unit is assured.

For further information see your local Chicago Pump distributor or write Chicago Pump for Bulletin 122-D.

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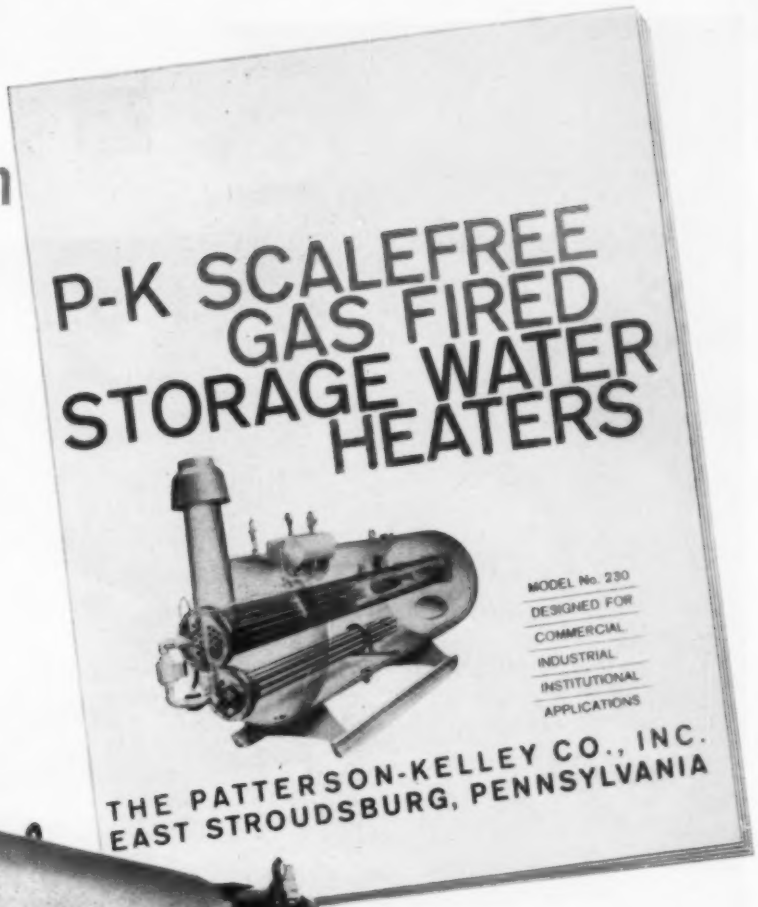

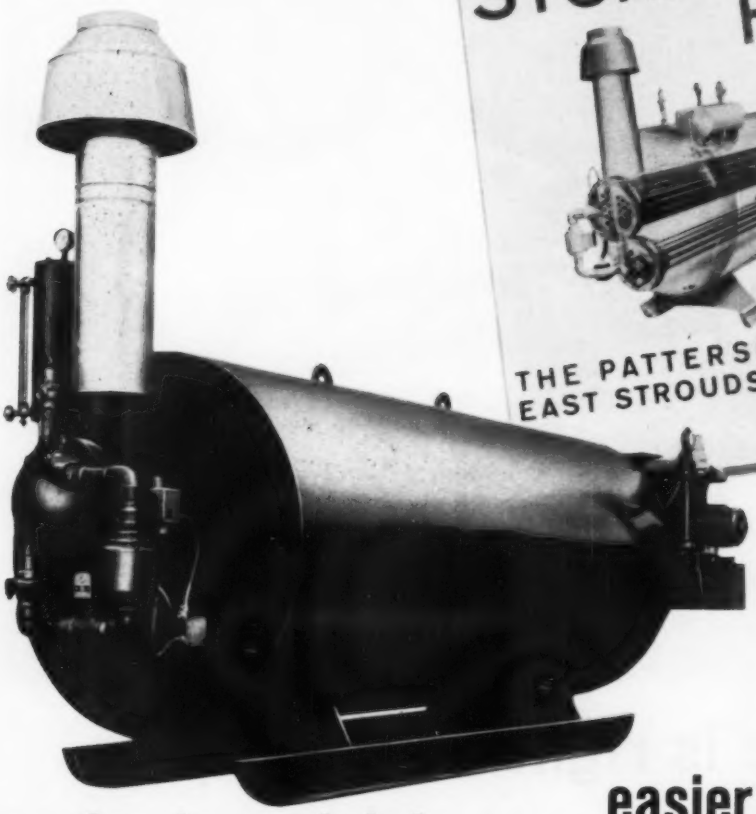

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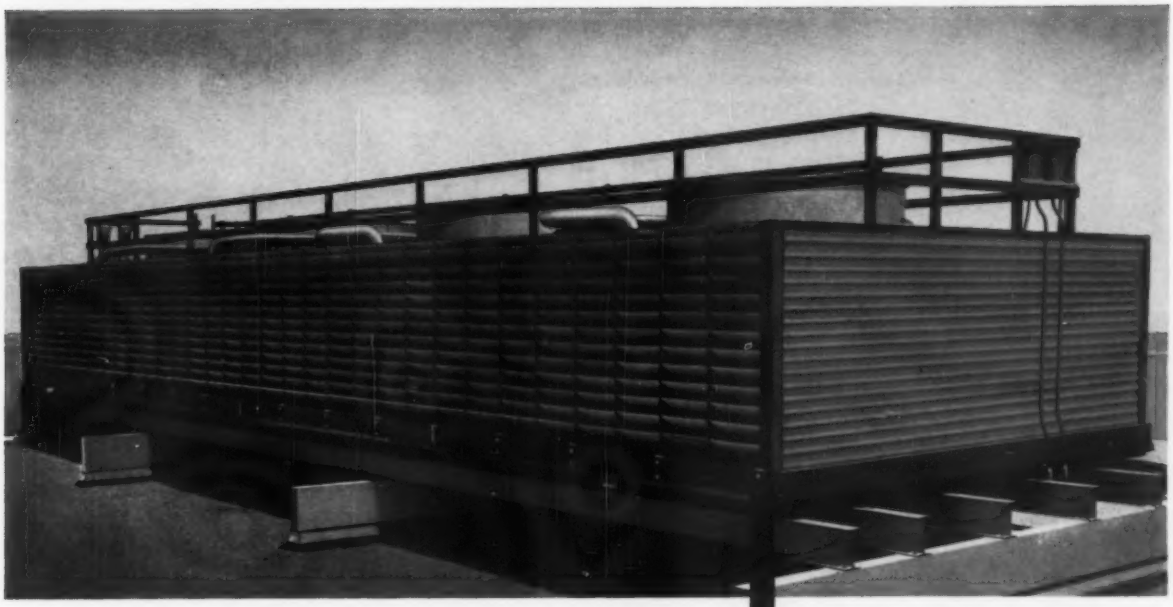
FLUOR COOLING TOWERS



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You'll get more cooling at lower cost, and longer tower life under all operating conditions with Fluor Cooling Towers. From heavy industrial installations to light central station air conditioning and refrigeration units, there's a Fluor Cooling Tower to meet your specific needs.

higher performance

lower maintenance cost

built-in permanence*

Fluor PRODUCTS COMPANY **COOLING TOWERS**

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Architects: Cannon & Mullen, Salt Lake City

Air Conditioning from A to Z

From Acme to Zion National Park . . . complete Acme comfort conditioning for the striking new Visitors' Center. Yes, the entire system . . . including two *Flow Therm* Packaged Chillers, two Multi-Zone Air Handling Units, one *Econ-O-Mizer* Cooling Tower . . . bears the name Acme, one of the oldest, most respected names in air conditioning equipment.

And with this Acme system, perfect year around climate control is maintained in every area of the Visitors' Center. In variable weather the system shifts instantly from heating to cooling as conditions require. Sun and wind loads on different sections of the building are automatically compensated for . . . heating one section while cooling another, if necessary.

Certainly, the ideal temperatures and humidities of the dust-free Acme-conditioned air in the Center are an appreciated boon to Park personnel and visitors alike. Acme equipment is highly regarded, what's more, by the architects, engineers and contractors who specify and install air conditioning systems. For example, Mr. Roy Cowley of Wright, Cowley & Evans, consulting engineers on the Center job, has this to say "We have been very satisfied with the performance Acme equipment has given us, both on this job and on others. It's as good as anything on the market and we have nothing but confidence in Acme." You'll have "nothing but confidence in Acme", too, when you hear the complete story – get it from your Acme representative.

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Undivided responsibility for *all* phases of a temperature control installation — from coordinated planning to future service — is the key to lasting owner satisfaction. Each Johnson System, small or large, is furnished on this basis, for 75 years' experience has proved it to be the *only* way to assure the kind of lifetime efficiency and operational economy an owner expects from his control system.

When they invest in a Johnson Pneumatic Control System, your clients are investing in years of reliable performance, something hardly to be expected from scattered sources whose responsibility ends with the sale. With air conditioning, heating, and ventilating systems becoming increasingly complex, now it is even more important that responsibility for the control system be centered in one organization.

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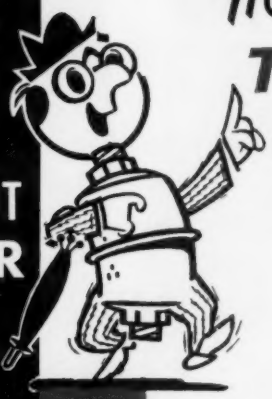

Mr. A. D. K. says:

To Protect the System and Yourself use the

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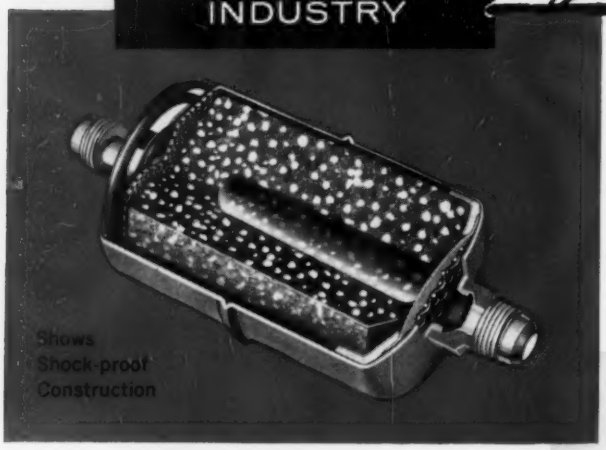

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5. Rigidly controlled activation—factory sealed.
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9. Full flow fittings mean low pressure drop.

ALCO DRI-KLEANER is your insurance for a longer, more trouble-free system life.

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- *BUY QUALITY*
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Temperature in new Royal Orleans Hotel held ±1° F by two Chrysler centrifugal water chillers in series

In a hot, humid climate like that of New Orleans, it's essential to have accurate control over both dry-bulb and dew point temperatures. That's why the new Royal Orleans Hotel decided on a double duct air conditioning system using two Chrysler centrifugal water chillers *in series.*

This combination makes it possible to control chilled water temperatures to within 1° F . . . and refrigeration capacity to within 10% of capacity. The double duct system makes available both chilled dehumidified air, and warm air, at every point for accurate, individual room control of temperature and humidity.

Two Chrysler centrifugal water chilling units were selected because they are more efficient . . . they each produce 276 tons, with only .84 brake horsepower per ton. And they're more economical . . . with 20% more chiller and condenser surface available, they reduce power consumption.

Flexibility, economy, efficiency, control—these are but a few of the reasons Chrysler centrifugal water chilling units and other air conditioning equipment are so often specified in the important jobs. For more information, or the technical cooperation of a Chrysler Engineer, write today.

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NEW NON-COMBUSTIBLE VAPOR BARRIERS ARE SELF-EXTINGUISHING!

Installing Pyro-Kure-faced insulation over air-conditioning ducts.

Part of our business is manufacturing vapor barriers — to stop moisture and prevent condensation. A problem: produce a superior vapor barrier that is *non-combustible*. We've done it! Called *Pyro-Kure*, it is available in rolls of various widths and in many combinations — foil, paper, plastic film. They can be reinforced for amazing strength. There is no other vapor barrier like it on the market. It is the first and only *permanent* non-combustible vapor barrier with an unqualified U/L flame spread rating.

Pyro-Kure now makes it possible for these specifications to be fulfilled: *a vapor barrier with a permanent flame spread rating: kraft side-25; foil side-5*. It is now being used by leading insulation manufacturers for insulation facings, pipe jacketing, duct lining.

If you or your firm is interested in the concept of "total fireproofness" in construction, you will want to know more about this development. Pyro-Kure self-extinguishing vapor barriers may have a use in a current project. Write American Sisalkraft, Attleboro, Mass. for a complete file of data, facts, figures and samples. No obligation.

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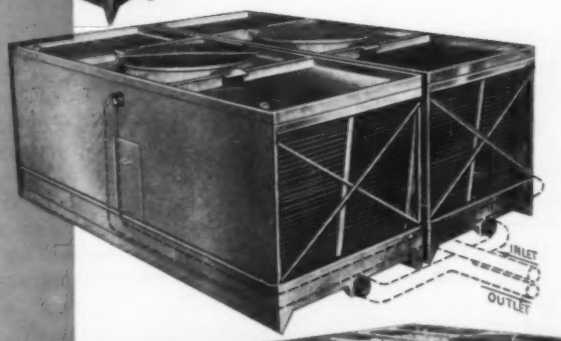

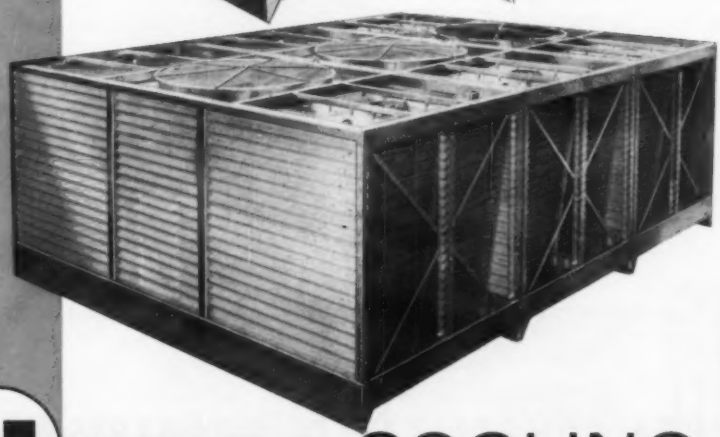

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FANDAIRE AIR-COOLED CONDENSERS

Now Fandaire Condensing Units are available in a full range of sizes from 3 HP through 90 HP – complete with the Fandaire air-cooled condenser and single, dual or multiple compressors.

Units use the original circular design that incorporates exclusive Yuba fintube with its high heat-dissipating efficiency. Every degree of temperature drop is fully used as the circular design approaches true counterflow—where the coolest air is in contact with the coolest gas. Its powerful fan pulls air in from the sides where it is as much as 4° cooler than air from below. Warm used air is pushed up and away. As air is captured from *any* direction, *any* breeze increases the unit's capacity.

The Fandaire Condensing Unit has the highest ratio of capacity to actual size of any condensing unit on the market today.

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Marsh Presents

A Superior Adjustable Orifice Valve

Here is the answer to easy, highly efficient balancing of both steam and hot water systems...a radiator valve in which you can accurately adjust orifice opening with the twist of a screwdriver; without shutting down the system; without breaking the union connection.

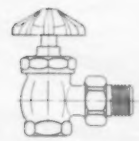
A stop screw in the valve stem, as illustrated here, enables you to set the modulating cone for any required flow: on steam, from 10 to 100 sq. ft. E.D.R.; on hot water, to any indicated flow at any given pressure.

Read opposite how simply and effectively the flow is adjusted. Once the opening is set, the special taper of the modulating cone assures the correct flow of steam or water through the orifice at any opening. In other words, the flow curve through the valve at *any* given pressure is a *straight line* throughout the full range of valve opening. Since the adjustment only limits the amount of opening, shut-off is positive at any adjustment without disrupting orifice setting.

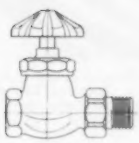
The stop screw in the sectional view below provides the orifice adjustment. Simply close the valve, remove the handle-screw and insert screwdriver in the open stem to engage slot in stop screw. Turn the stop screw as far down as it will go. Then back it off to the required orifice opening.

In a steam system, back stop screw one turn for each 10 sq. ft. of direct radiation. In a hot water system, as many turns as indicated by flow requirements of system, either precalculated or checked by devices for determining flow.

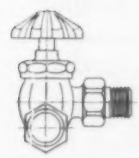
Note that valve is non-rising stem type and can only be opened to position permitted by stop screw setting. Provision is made for sealing the adjustment tamper-proof after setting orifice.



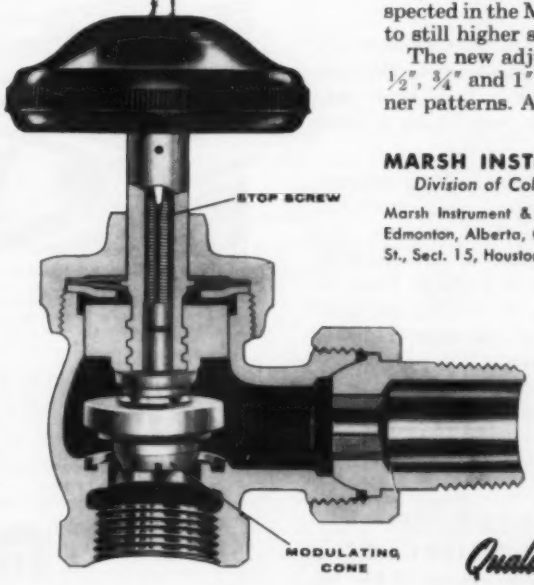
Angle



Straightway



Corner—either right or left hand



A new valve with time-tried Marsh design

This feature is all the more significant because it is found in a valve that incorporates the truly packless, metal-to-metal seal construction so highly respected in the Marsh R-100 series and now brought to still higher standards.

The new adjustable R-105 series is available in ½", ¾" and 1" sizes; angle, straightway, and corner patterns. Ask for special bulletin.

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Division of Colorado Oil & Gas Corporation, Dept. T

Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada; Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas.

MARSH

Quality Heating Specialties since 1865

At Heinz—cleanliness starts with sidewalks kept spick and span with **steel pipe** snow melting

In Heinz plants throughout the world—cleanliness is a prime requisite. And cleanliness at Pittsburgh headquarters begins with the sidewalks . . . sidewalks which are kept free of dirt-tracking snow, slush and ice throughout the winter.

The above photograph of the Heinz sidewalks demonstrates *steel pipe* snow melting at its best. It was taken when traffic came to a standstill after a storm dumped 12″ of snow in 12 hours onto streets. Yet 1 hour after the storm—walks were clean; 3 hours later, dry as a bug in a rug.

No wonder *steel pipe* is first choice for snow melting systems. *Steel pipe* is not only efficient . . . it's economical, easily available, easy to work and join, load supporting. Important, too, *steel pipe* is compatible with most materials. These same advantages make *steel pipe first choice* for plumbing, vent and drainage lines; for electrical and communications conduit; for ice making, refrigeration and fire prevention systems; for gas, air and water transmission; and for structural and construction uses.

In steel pipe snow melting systems, straight lengths and coils can be quickly joined on the job. Because the expansion coefficients of concrete and steel are almost identical, concrete cracking due to expansion and contraction is minimized.

Steel

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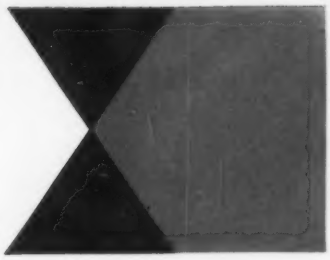
- Available everywhere from stock

Insist on USA Steel Pipe

C-6

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.



"Open for Discussion"

Air Curtain, Campus Heating, Make-Do Answers to Architect's Errors

TWO ARTICLES in the December 1960 issue deserve a close look by mechanical engineers everywhere because they are typical of what is wrong with our profession. The two articles are *Double Loop Steam System Heats High School Campus*, by Elwood S. Tower and *Wind Tunnel Tests Help Design Air Curtain Entrance*, by Norbert Zehnder.

These titles are innocent enough in themselves. It is not until the articles are examined that we find two more of the many examples of installations where the design engineers must "make do" with an expensive monstrosity which has been sold to the client by a fast talking architect. In every case there is always a high sounding "gimmick" which is supposed to justify this extravagance and obviate the need for sound design and cost engineering. In one case this is a "plateau" designed campus which is supposed to permit students to fraternize only with their own age groups. In the other case, this expensive air curtain installation will permit air terminal passengers to enter and see immediately where they are going.

These are truly earth shaking problems and certainly justify the exorbitant expenditures needed to keep our children from being unduly influenced by their fellow students, and to keep our air passengers on the straight and narrow path to the right airline. These great unsuspected difficulties should be news to true educators and to airline passengers alike.

How much longer must qualified engineers stand aside and be forced to deal with these problems second hand? Certainly the time is long overdue when engineers must be given full authority to veto projects which are unsound in design or in respect to the cost to the client. Architects have been entirely too glib in selling these installations on the basis of the alleged advantages and have conveniently ignored the back breaking and continuing costs.

I have no quarrel with Mr. Tower or the design which he selected for the specific problem. But that the installation is costly beyond the needs of the high school would seem self evident. The fact that a steam capacity of 30,000 lb per hr is installed for this job makes it even clearer. It is obviously impossible to heat such a collection of buildings as economically as it is for a single conventional structure. And I might add that a really outstanding architect is one who can design a beautiful, practical building within proper financial limits.

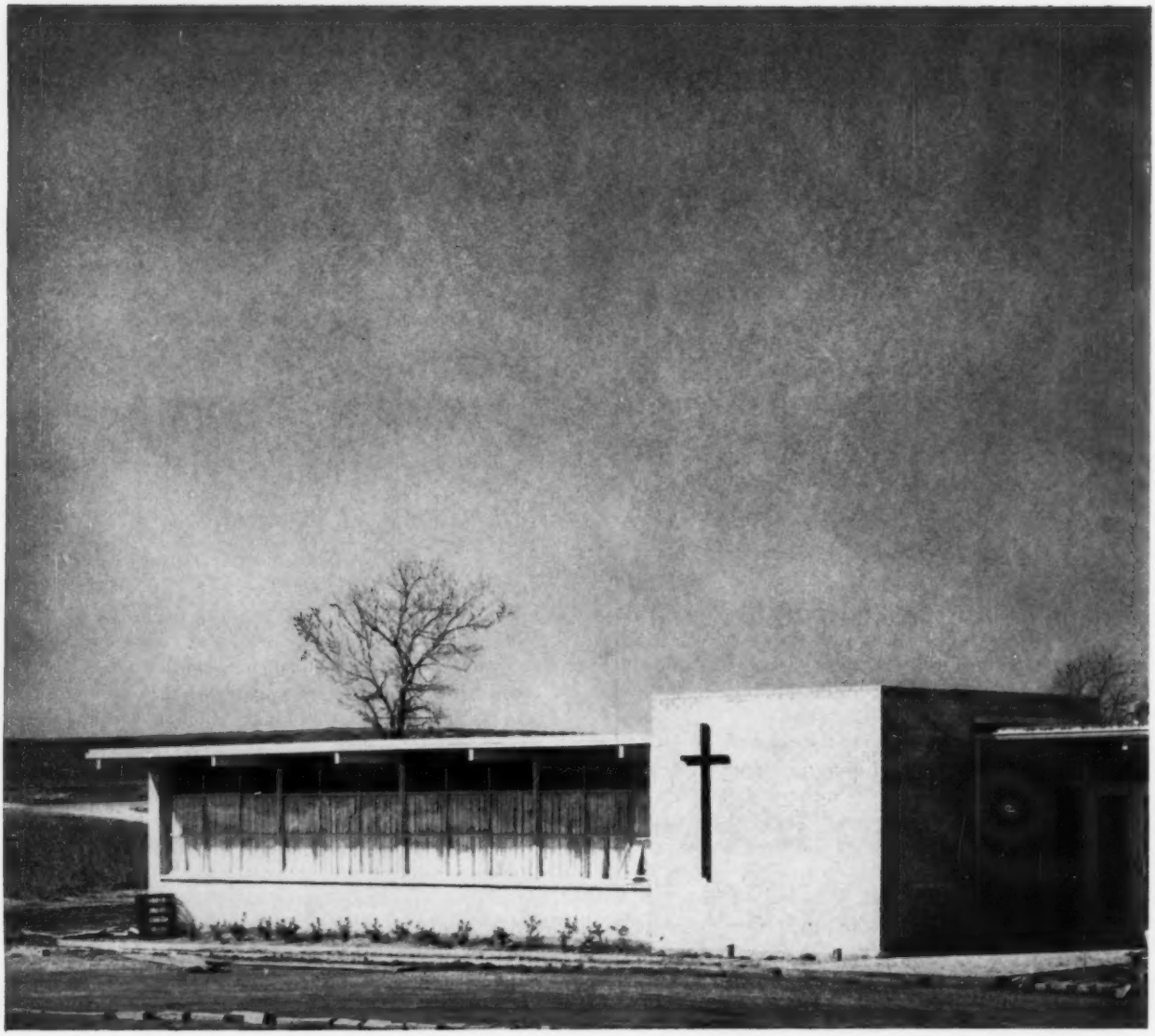
At first blush one would be inclined to think that there was truly great consideration for the best interests of the students and faculty. But such simply is not the case. Separate buildings make it difficult to use the teachers and classrooms expeditiously. All must move from building to building in inclement weather requiring outside apparel and places to put the apparel, in each building. Students in gym or swimming who are wet and sweaty must go out in the cold or rainy weather to get to other classes, the library, or to lunch. I submit that this is sheer madness.

For those who may wish to hear the economical side of sound school construction I strongly recommend that you read the article "*How to Have More School for Less Money*" by Charles Stevenson, which appeared in the February, 1959 issue of Reader's Digest. Reprints are obtainable by writing the Reprint Editor, The Reader's Digest, Pleasantville, N.Y.

As for the air curtain, it is given a bit of dignity by the model tests which were run on the installation. These tests have meaning only when the facts are all known and properly interpreted from experience. The air deflectors at the entrance should be applauded, and would be a fine addition to any entrance — if an engineer is ever lucky enough to talk the owners into spending the money for them.

But unless Mr. Zehnder has discovered new prin-

(*Continued on page* 84)

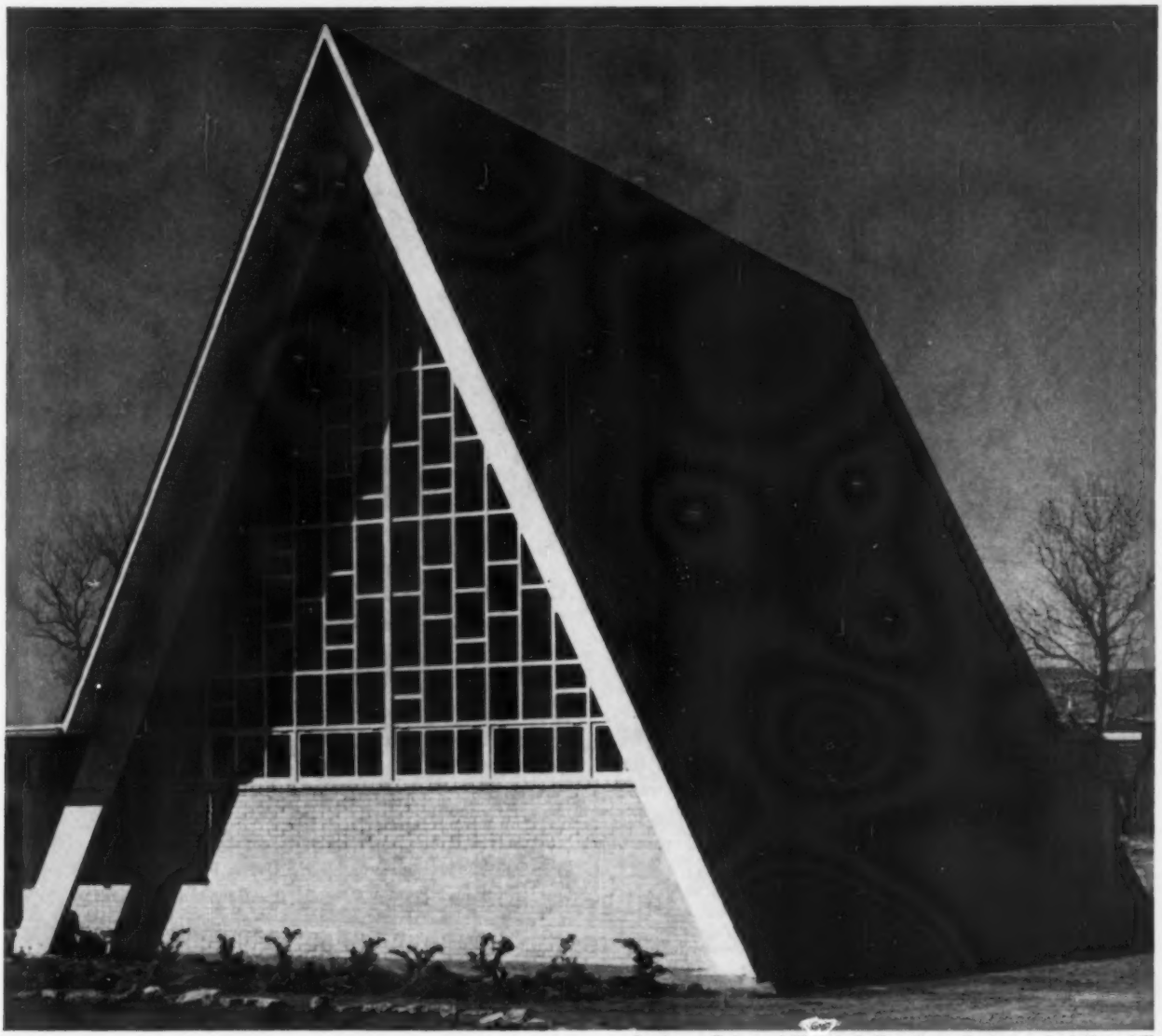


now we're cooling...

It's comfortably cool in this strikingly modern church—even with the Texas sun burning against its tall and beautiful glass wall. The system is the most modern, too—an Arkla-Servel gas air conditioning unit.

After careful study backed with successful experience in previous jobs, the architect specified gas and Arkla. "The main reason is performance. What could be easier. You just set it, and forget it. Of course, economy plays a big part, too . . . but basically it's the trouble-free operation."

You or your clients can have this same efficient year 'round operation. For specific information, call your local gas company, or write Arkla Air Conditioning Corporation, General Sales Office, 812 Main Street, Little Rock, Arkansas. *American Gas Association.*



St. James Episcopal Church, Dallas, Texas. Designer: Jack Hemphill

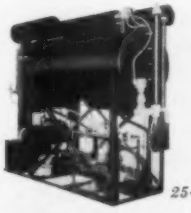
with GAS!

Arkla-Servel Sun Valley 3½ and 5-ton gas air conditioners are compact, central units that eliminate the need for fans, window air conditioners or separate cooling units. They cool, heat, clean, dehumidify and distribute air for year 'round comfort at low cost.

For larger installations: Arkla-Servel 25-ton gas absorption units use low pressure steam from a gas-fired boiler as the source of energy for the chillers. They're compact, easy to install and adjust automatically to heat loads. They do not cut out at high loads, since capacity increases with rising temperatures.

FOR HEATING & COOLING GAS IS GOOD BUSINESS!

3½ and 5-ton



25-ton

GAS-OPERATED ARKLA-SERVEL AIR CONDITIONING UNITS
lowest operating costs • fully automatic operation • long dependable service
packaged construction • compact size • easy installation

"Open for Discussion"

Continued

ciples of dynamics and fluid flow, no 7 ft wide mass of air has a chance to stop a 12 ft high mass of air moving at higher velocity, even if the "curtain" were 180 deg opposed. I doubt if Mr. Zehnder would claim that it does.

The air curtain can, under favorable wind conditions, neutralize the effects of the outside air. But this is done at great cost in terms of the air handling equipment, controls, heating and cooling equipment, maintenance and operation.

Any column of air acts as a jet and induces large quantities of adjacent air to flow with it. This is where the large losses occur in the air curtain. It is staggering that such an installation should require 600,000 cfm — six 75 hp fans at 100,000 cfm each. I am sure that automatic doors could be installed for the 80 ft entrance with little, if any, inconvenience to the passengers, and at a fraction of the cost of the air curtain installation. In fact, the cost of the fan installation alone would pay for the doors, and the doors would be effective *all* year long, during good and bad weather. My observation of an operating air curtain door leaves me unimpressed with the "gentle" breeze "separating" the interior from the exterior. Mr. Zehnder would be more to the point if he would come up with some convincing data on the actual heat losses (or gains) and the installed and operating costs for his air curtains.

JOHN H. CLARKE
Engineering Design Supervisor
Air Conditioning and Power
The Visking Co.
Div. of Union Carbide Corp.

Mechanical Deaerator in Feed System Is Most Effective Boiler Protection

IN REPLY to the question, *How Can We Protect Boilers' Internal Metal Surfaces?* in the November 1960 issue, I offer the following comments on John W. Turner's solution.

All of the measures outlined by Mr. Turner will do the job. However, the most efficient way to prevent corrosion of internal boiler surfaces is to prevent entrained oxygen and CO_2 from entering the boiler. This is accomplished simply by the addition of a mechanical deaerator in the feed system. A deaerator which reduces dissolved oxygen to 0.03 cc per liter is adequate for most plants, and absolutely essential for high pressure boilers, if dissolved oxygen is a problem either in makeup water or condensate return.

The main objection to treating boiler feed water for dissolved oxygen with most of the chemical compounds designed for that purpose is that the protective coating which they place on the internal surfaces of the boiler impedes heat transfer by a small amount from fire side to water side, thus reducing boiler efficiency. Whether or not the increase in efficiency due to the action of the compound itself in preventing oxide formation offsets this decrease is academic in light of the fact that a deaerating feed system will positively control oxygen while adding nothing to the feed water.

A 0.03 deaerator can be installed in most boiler feed systems at modest cost, and, together with the practices recommended by Mr. Turner, will pay dividends which may offset the cost of installation within a year just in savings on replacement of plant steam distribution piping, traps, valves, etc., not to mention the cost of retubing the boiler.

J. P. PROSSER,
Asst. Plant Engineer
Missile Systems Div.
Raytheon Co.

One Pipe Brine Distribution Has Merit, Requires Usual Careful Designing

THE well written and well documented article *Proposed: A One Pipe Brine Distribution System*, by Herman Vetter (January) is, in my opinion, fair to both the two pipe reverse return system and the one pipe system.

The author has identified both the advantages and disadvantages of each system. One of the distinct advantages of the one pipe system mentioned by Mr. Vetter is that of increased heat transfer between a cold fluid and the heat transfer surfaces, as a result of greater turbulence resulting from high velocity of the cooling fluid.

There can be no question but that any system or method that accelerates heat transfer between a primary or secondary refrigerant and a surface to be cooled, while not interfering with other essential functions of a process, is highly desirable.

Another advantage cited by Mr. Vetter is that there are no restrictions as to the quantity of brine that may be circulated through, say, calenders in a wax paper plant. This same advantage should apply quite generally to other operations.

It is true also that the cost of installation for the one pipe system as compared to that of a two pipe reverse return system definitely favors the former.

Regardless of the type system selected for a given case, it goes without saying that the system decided upon must be properly designed and correctly installed, as otherwise operating results will be unsatisfactory. Not only must pipe sizes be carefully selected, but practical provision must be made for the quick removal of entrapped air in the fluid.

C. T. BAKER
Consulting Engineer

A new development by Iron Fireman

WhirlBlast

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NO SMOKE

Burns clean in less than 10 seconds. The WhirlBlast flame is brilliantly clean almost instantly, and stays clean. Although accepted standards of oil firing allow a 15 minute warm-up period, during which time smoke is tolerated, the Iron Fireman WhirlBlast burner is clean in seconds. Smoke and soot are unburned fuel—completely wasted by smoky starts.

NO STACK

Needs only an exhaust vent. Boilers with conventional burners require from 30 to 80 feet of stack or an induced draft fan. Sealed steel firebox boilers with WhirlBlast burners require only a small exhaust vent.

CONSERVES BOILER HEAT

Standby loss is almost nil. The highly efficient WhirlBlast burner does not need a refractory combustion chamber to "support combustion." Consequently there is no brickwork to store heat to be wasted during "off" periods. Standby heat loss is reduced to an insignificant minimum.

CUTS COSTS

Low fuel bills; low maintenance. Efficient combustion and low standby loss conserve fuel. Elimination of smoke and soot means no fouled boiler tubes, no carboned nozzles or electrodes; no refractory maintenance expense.

A COMPLETE PACKAGE

No special skill to install, adjust, service or operate. The WhirlBlast burner (for gas, oil or dual-fuel combination) comes from the factory fully wired and tested. Bolts to boiler front with firing head through fire door. No special combustion chamber or firing pit needed. Exceptional installation saving.

Send coupon for further information.

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT
FOR HEATING, POWER, PROCESSING

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15 acres
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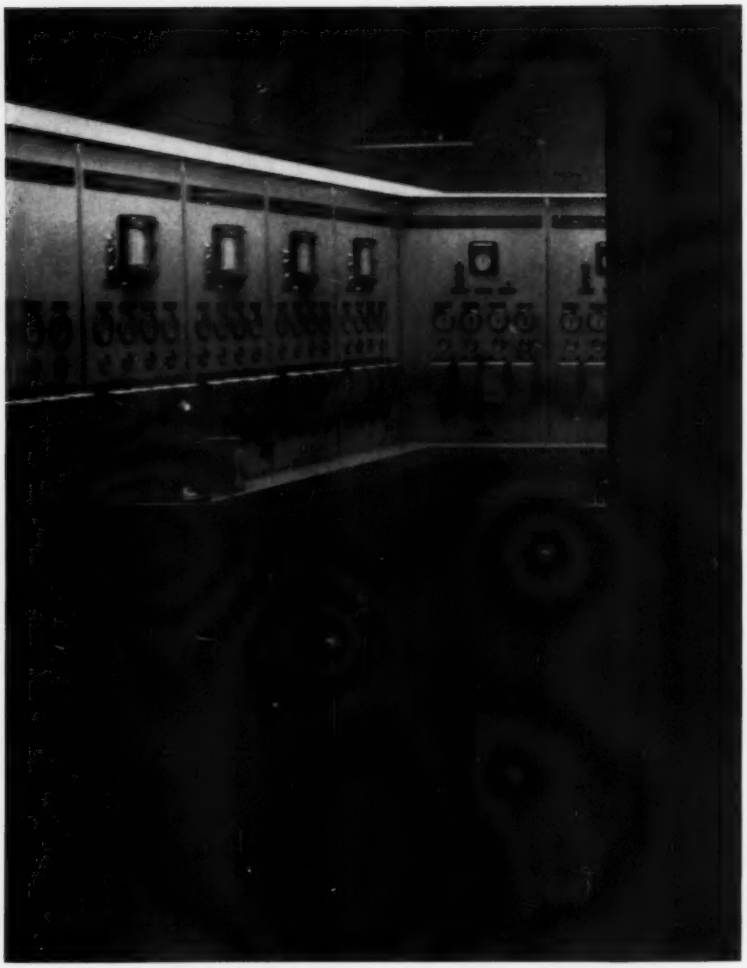
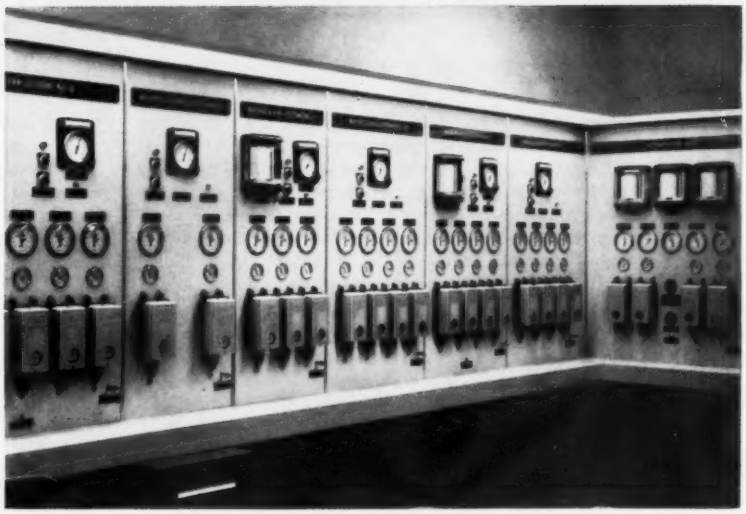
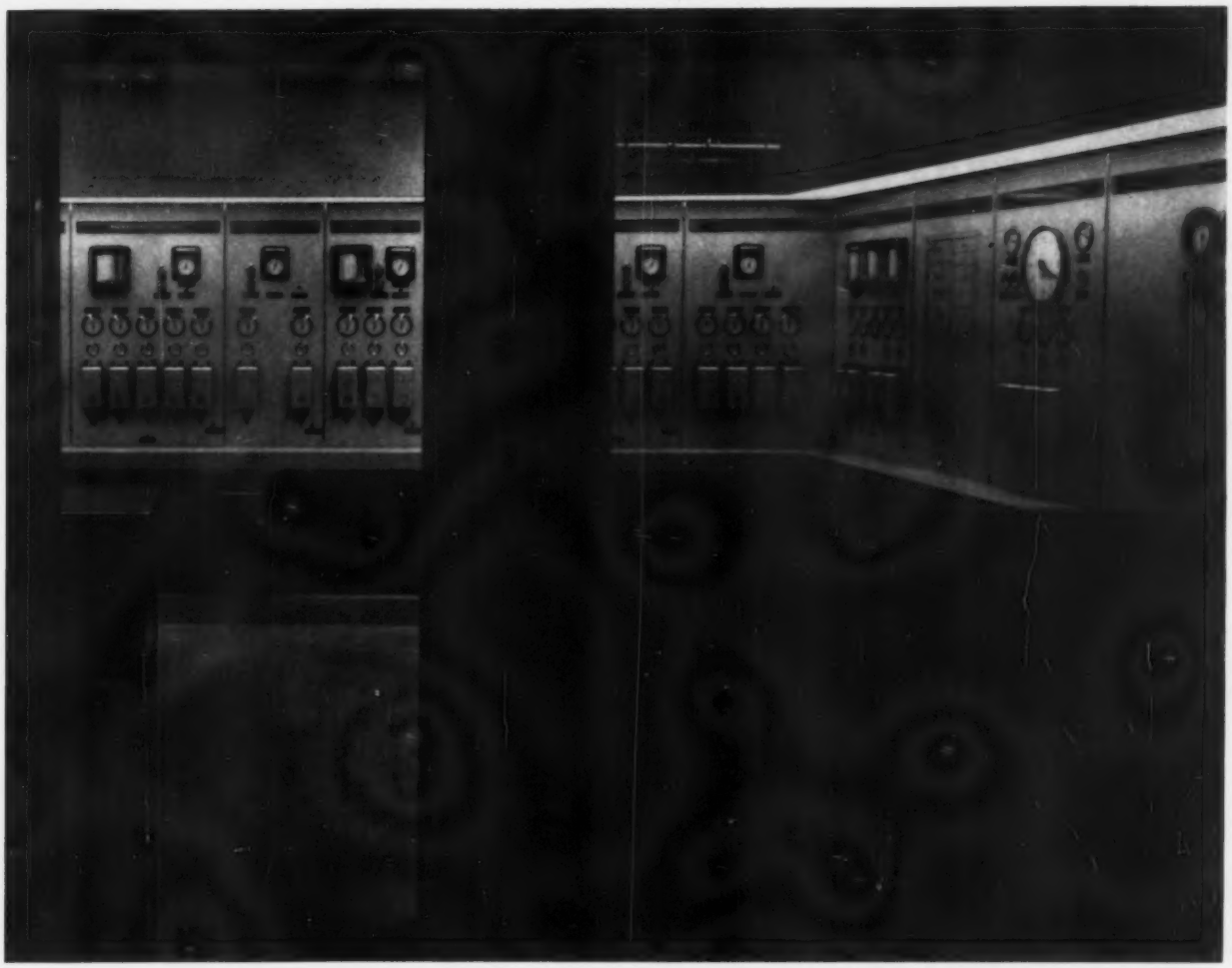




Taylor Instruments



Some of the Taylor Instruments on the central air-conditioning control panel at Hanes Hosiery Mills Co., Winston-Salem, N. C. Engineered and installed by Johnson Service Company under supervision of P. L. Davidson, Consulting Engineers, Greensboro, N. C.

At HANES HOSIERY MILLS Co., Winston-Salem, N. C., there are 14 air washers, using 49 vane axial fans and 2 centrifugal fans, to air condition 15 acres of floor space. The system was engineered and installed by Johnson Service Company and employs a combination of Taylor and Johnson instruments.

The air washers are controlled by Taylor TRANSCOPE* Controllers, receiving signals from SENSAIRE* Transmitters which are indicated on TRANSET* indicators. TRANSCOPE two-pen Recorders are located at strategic points on the panel. Heating coils and associated damper systems are Johnson controlled.

Three 1,100-ton centrifugal refrigeration machines, and three 200-hp air compressors for the knitting machines, are also under Taylor control.

This system provides more than a million CPM of conditioned air in the Hanes Mill. Areas served include Knitting, Looping and Inspection, Pre-Boarding, Greige Storage, Dye House, Finishing, Shipping, as well as office, shop, receiving, maintenance, and cafeteria. Entire mill is completely air conditioned, except boiler room and basement.

Whether you use air-conditioning for human comfort or maintaining product quality, Taylor Instrumentation will insure dependably uniform operation of the equipment. And remember when you specify instrumentation by Taylor you get the added benefit of years of experience in this field.

• • •

Ask your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, New York, or Toronto, Ontario.

*Reg. U.S. Pat. Off.

MEAN ACCURACY FIRST

question of the month

"Will Higher Boiler Temperature Cause Corrosion, Other Problems?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with several answers that have been received from readers. Other solutions or comments for publication are invited.

"I have charge of the operation and maintenance of hot water boilers which supply heat and hot water to apartment buildings. The hot water is supplied by means of boiler water circulating through coils in a storage tank. The boilers have been operating at temperatures of 190 to 200 F, and at a water pressure of 22 psi.

There has been trouble supplying hot water at the proper temperature due to a load which is now larger than originally designed. One solution considered is that of raising the boiler temperature to 210 F. Other operating conditions would remain the same.

Are there any corrosion or other problems which will arise due to the increase in water temperature to 210 F?"—M.U.

Corrosion Can Be Forestalled By Adding Hot Water Coil, Second Heater

IN ANSWER to the question regarding any corrosion which might arise due to raising the boiler water temperature so that the operator might increase his hot water load in an apartment building, I would reply as follows:

In the closed circuit system on his boilers, he should experience no additional corrosion problems due to raising the boiler water temperature from 190 to 210 F, with proper chemically treated water.

In the domestic hot water circuit, which has a continuous draw, he would be subject to increased corrosion conditions due to the increased hot water temperature. The amount of corrosion would, of course, depend on the condition of his service water.

If the control system in his apartment building is tied in with an outside controller to regulate boiler water temperature, it would appear to me that the best approach to take would be to increase the size of the heater in the domestic hot water tank, if this is feasible, rather than increasing the boiler water temperature; or, if necessary, to add an additional tank.

A. J. BEALL, JR.
Beall & Associates
Engineering Consultants

Doubts Much Corrosion Increase, Recommends Increased Coil Size

THE QUESTION regarding boiler operation and the possibility of increased corrosion due to higher temperatures is interesting.

First, I would like to say that as there is no mention of the type of boiler used for heating, and since this is a hot water system, I see no worry about any more corrosion from 210 F water than from 190 or 200 F water.

Further, I don't think that raising the water temperature will help much in his problem of supplying domestic hot water from his tank coil storage system. My answer would be to pull the existing tank coils and install higher rating capacity coils for greater recovery from temperature drop in the hot water storage system.

Here in one of our schools we have a similar system, using 190 to 212 F water, and heating domestic

(*Continued on page 92*)

Why Every Steam Heated Unit Needs its Own Steam Trap

. . . the theory, practice and proof of "unit trapping" for top temperatures

Using an individual trap for each steam heated unit, including each separate coil, chest or chamber of a machine—pays off for the user. Here are just two examples:

1. On a creamery dryer

Drainage Method	*Air Temperature*
Restricted Blow-thru	250°
Group trapping (1 trap for 8 coils)	225°
Armstrong Unit Trapping (8 traps—1 for each coil)	**309°**

2. On a platen press

Drainage Method	*Processing Time*
Restricted Blow-thru	50 minutes
Group Trapping	35 minutes
Armstrong Unit Trapping	**25 minutes**

Why Unit Trapping Works Best

It is reasonable to assume that no two steam heated units will have *identical* condensing rates. Even the slightest difference in rate will cause a difference in steam pressure drops through the units. Here's where the trouble starts. Condensate from each unit may flow to the trap. But, what about air and other non-condensibles in the system? A difference in pressure drops too small to be indicated by an ordinary pressure gauge will permit backflow of steam from the higher pressure units to the lower pressure units. This backflow of steam may even impede flow of condensate from the lower pressure unit to the trap . . . and it will definitely impede or block off flow of air to the trap. The result is sluggish heating, reduced temperatures, reduced output, fuel waste and increased possibility of corrosion. Figures 1, 2 and 3 diagram the action.

Unit Trapping Not Costly

No engineer wants any more mechanical devices in his plant than are absolutely necessary. But, the moderate additional cost of using two or more small traps, instead of one big one, is saved over and over again in improved efficiency.

If the traps are Armstrong, maintenance is no problem. And users frequently tell us that Armstrong traps outlast others two and three to one.

Steam traps usually represent a fraction of 1% of the cost of the equipment they drain. Does it make good sense to lose 10% or more of equipment capacity to save a few dollars on traps?

Why not test Armstrong unit trapping in your plant. If you are not completely satisfied with the results you can return the traps for a full refund of the purchase price. There is little to lose—lots to gain. Call your local Armstrong Factory Representative or Distributor, or write **Armstrong Machine Works, 8742 Maple St., Three Rivers, Mich.**

ASK FOR the 44-page Steam Trap Book and reprint of article on Unit Trapping.

B015T

ARMSTRONG STEAM TRAPS

How Different Condensing Rates Can Slow Production

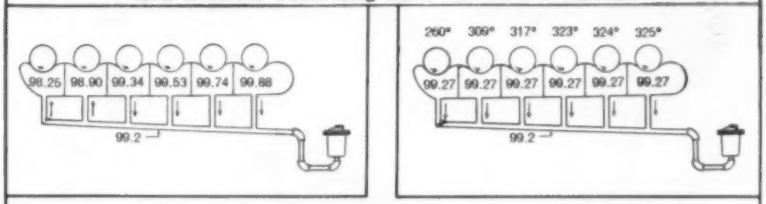


Fig. 1 This is a 6-roll ironer shortly after it has begun operating on 100 psi steam. When cold, wet material passes over chest 1, steam condensing rate is high and pressure drops accordingly. The pressure drop in chest 2 will not be as great, and so on down the machine as the material becomes progressively hotter and drier. Average pressure in the chests then is 99.27 lbs., and drain header pressure is slightly less, about 99.2 lbs. Under these conditions, steam from drain header enters chests 1 and 2 (as indicated by arrows at side of drain lines) because of pressure difference. Though condensate from chests drains by gravity, air can't leave chests countercurrent to incoming steam. Fig. 2 shows what happens next.

Fig. 2 This is the same 6-roll ironer after it has been operating a while. Air has accumulated in chests 1 and 2, reducing condensing rate and decreasing pressure drop. This process repeats itself down the line until pressures are as shown—that is, enough air will accumulate in each chest so that condensing rates and pressure drops of all chests will be about equal. The net result is shown in chest temperatures which are actual pyrometer readings taken on a 6-roll ironer, drained by a master trap, in a Chicago laundry. The laundry was making 337.9°F steam, but getting an average of only 309.6°F from the ironing surfaces, necessitating slow operation and frequent reruns. Then they tried Armstrong unit trapping—see Fig 3.

How Unit Trapping Prevents Trouble

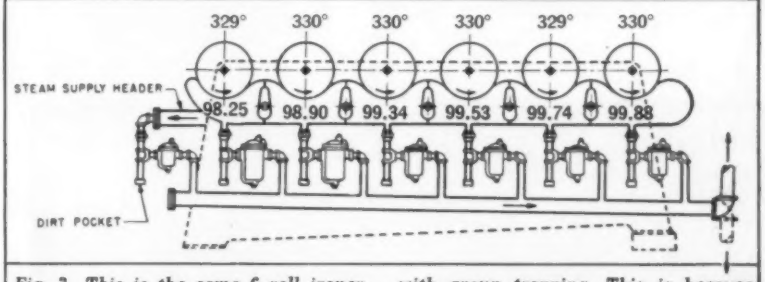
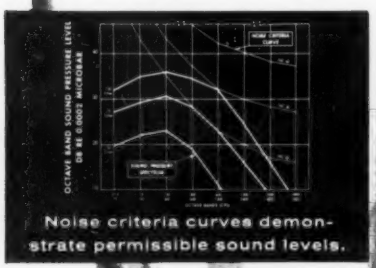


Fig. 3 This is the same 6-roll ironer, now unit trapped. Temperatures shown are also actual pyrometer readings—the average of 329.6°F is 20° higher than with group trapping. This is because air is continually removed from each chest into the drain header, and cannot get back into any chest.

What about the



Noise criteria curves demonstrate permissible sound levels.

Accurate performance data assures you of the best possible auditory environment.

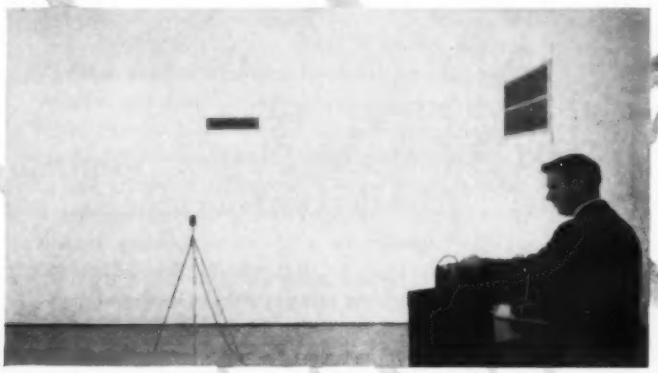
Ask to hear it: new Barber-Colman slide film, "Making Sound Behave."

auditory environment?

Facts about air distribution sound levels of importance to engineers and architects

An architect skillfully uses both color and light to create the proper environment. A good analogy exists between an architect working with frequencies of light (color) and an engineer creating ideal air distribution specifications with sound.

Until recently engineers used only the decibel level in selecting air distribution equipment. Today this is not



enough to assure comfortable environment, for sound must be measured and specified not only in terms of over-all magnitude, but also in magnitude at different frequency levels.

To help you create the proper auditory environment, Barber-Colman has built modern sound laboratories where engineers break down into eight octave bands the sound of air passing through Uni-Flo diffusers. The decibel value of each band then is charted for a complete range of capacities.

The results are twofold: data is available for comparison with noise criteria curves which are used for specifying permissible sound levels in different frequency bands; scientifically proved performance data is provided for correct selection of air distribution equipment.

Ask for literature and be sure to see — and hear — Barber-Colman's new slide film, "Making Sound Behave."

BARBER-COLMAN COMPANY
Dept. N, 1101 Rock Street, Rockford, Illinois

See our exhibit
Booth No. 506-508
International Heating & Air-Conditioning Exposition
Chicago, February 13-16.

question of the month

Continued

water in a storage tank with coil, but the coil has a high recovery heating rate and keeps the water hot at all times.

A lot depends on what his water temperature in the tank is required to be, and if it is set too high, it will certainly be difficult to maintain.

ALDEN C. BEALS
Maintenance Superintendent
School Department
Marblehead, Mass.

Questions Possibility of Much Increase in Supply Without Larger Coil

WE DO NOT believe raising the boiler water temperature 10 F will cause any serious problem as regards corrosion in the boiler. However, we question the amount of additional hot water that will be obtained. Of course we have no idea of the hot water requirements or storage capacity of the tank.

It would seem to us that a more feasible solution would be to increase the size of the coil in the tank, or possibly to use a separate booster coil on the hot water line out of the storage tank, and to circulate the boiler water through this booster coil.

It is assumed that there is ample boiler capacity and piping out of the boiler will be arranged so that proper circulation in the boiler can be obtained without causing undue strains within the boiler.

I hope this information is helpful. It should be noted that it is sometimes dangerous to even make suggestions without knowing the exact conditions, capacities, and requirements.

PAUL D. BEMIS
Bemis & Freeman
Consulting Engineers

Threaded Pipe Increases Susceptibility But Scale Increase Should Be Slight

WITH REGARD to the question of accelerated corrosion due to an increased boiler water temperature, it should be noted that pipe assemblies having threaded joints with attendant reduced wall thickness are more prone to failure as a result of corrosion than are flanged and welded joints. Also, if intermittent operation prevails, horizontal lines may be more troublesome because of incomplete drainage.

Solubility of corrosive gases such as O_2 and CO_2 varies inversely with temperature and directly with pressure. At 190 F and 22 psi, the solubility of these gases is approximately 6.7 cc per liter. At 22 psi and 210 F, the value reduces to about 5.6 cc per liter. This small difference is not sufficient to influence corrosion effects.

The principal cause of scaling is reduced solubility of scale forming salts at higher temperatures, with calcium and magnesium being the usual sources. Available data regarding the concentration of calcium carbonate with respect to water temperature and pH indicates that 190 and 210 F water temperatures do not have appreciable solubility differences. Usually, hot water quantity is great, and the problem of scale formation is seldom pronounced for this service.

No mention is made that corrosion or scaling problems are presently being experienced. Therefore, it is improbable that operation at the higher temperature will prove difficult.

H. B. WAYNE
Consulting Engineer

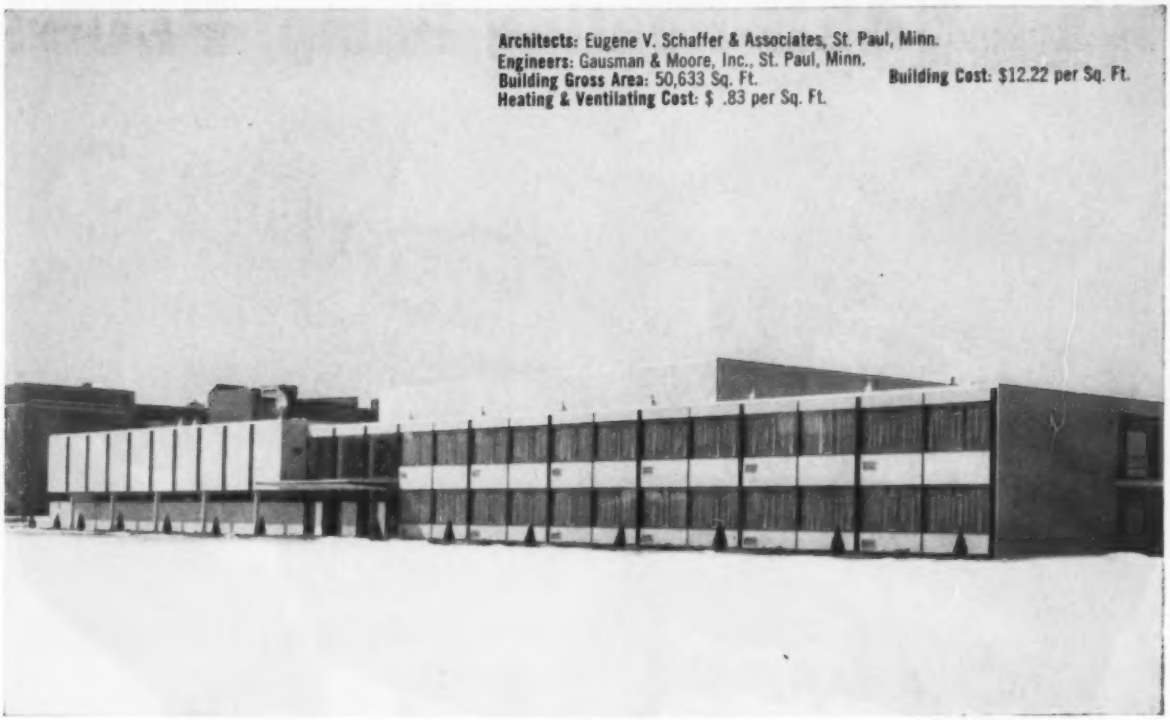
READER ASKS—

"How Should Radiant Heating Systems Be Protected From Freeze-up?"

"We would like to know what measures should be used in protecting radiant heating systems installed in floor slabs against freeze-up when the system is shutdown for repairs or on low demand.

"Our primary interest is to learn what chemical anti-freeze solutions have been used with success without risking any possibility of corrosion being caused in the piping system. We realize that one method that will probably be suggested will be to keep the pumps circulating constantly. However, this is not practical in all cases, and we would like to learn from other readers what experiences have been encountered." — R.J.T.

YOU ARE INVITED to contribute a question for publication or an answer to a published question.
Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.



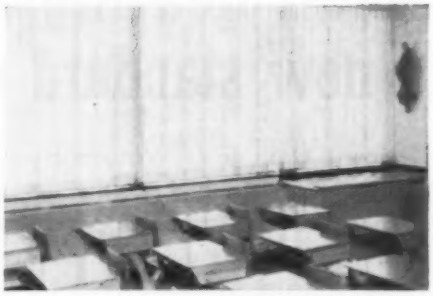
Architects: Eugene V. Schaffer & Associates, St. Paul, Minn.
Engineers: Gausman & Moore, Inc., St. Paul, Minn.
Building Gross Area: 50,633 Sq. Ft. **Building Cost:** $12.22 per Sq. Ft.
Heating & Ventilating Cost: $ .83 per Sq. Ft.

room-by-room and school-by-school . . .

NORMAN SCHOOLROOM HEATING AND VENTILATING SYSTEMS

cut construction costs . . . and reduce operating expenses

83c PER SQ. FT. installed, provides thrifty, efficient gas heat plus automatic forced air ventilation in the De LaSalle High School Addition, Minneapolis, Minnesota.



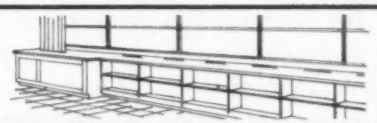
By specifying a Norman Schoolroom Heating and Ventilating System for each individual classroom, the planners of the all-modern De LaSalle High School Addition, Minneapolis, Minnesota, were able to reduce heating and ventilating costs to a mere 83¢ per square foot.

No separate building was necessary to house a central heating plant . . . no tunnels or trenches for ducts or pipes . . . no unsightly chimney . . . no oversizing of boilers or pipes for future expansion. As the school grows additional Norman Systems can be added.

In one low cost package, the Norman Gas-Fired, Forced Air Perimeter Schoolroom System provides complete classroom comfort for each individual room. Fresh outdoor air is automatically blended with recirculated room air to heat and ventilate, with scientific air distribution through perimeter diffusers in Util-i-Duct bookshelf sections. Additional Norman gas-fired units can be installed in non-classroom areas.

Automatic temperature setback with recirculation of room air during unoccupied periods (80% of the school year) keeps fuel bills at a minimum. Servicing is simplified and any maintenance can be quickly and economically performed.

Write today for comprehensive Manual on HVS Horizontal or Inn-A-Wal Counter Flow models.

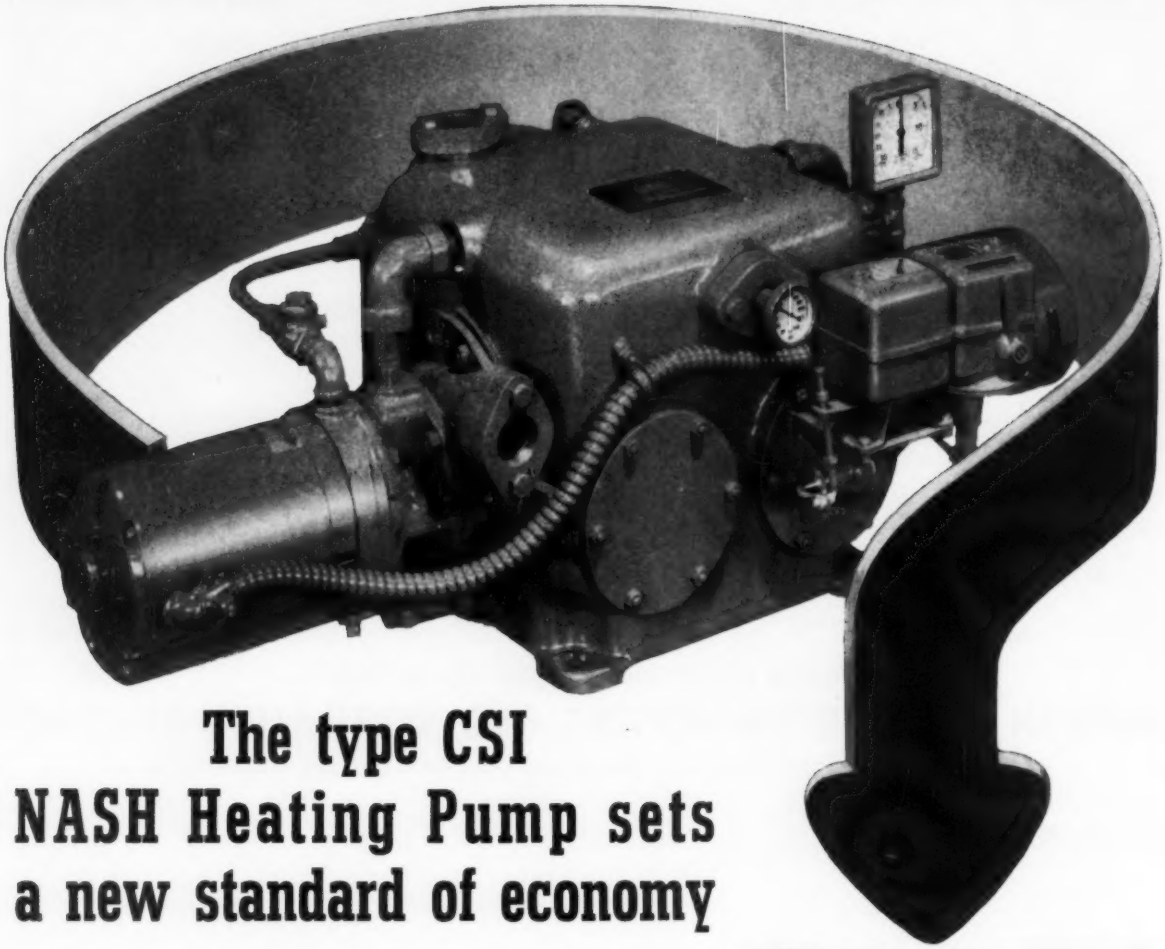


NORMAN ENCLOSED HVS compact horizontal unit illustrated with Util-i-Duct bookshelf sections

NORMAN INN-A-WAL counter flow furnace in separate heater room, illustrated with economical Wall-i-Duct sections

Norman® PRODUCTS CO. division of **JOHN J. NESBITT, INC.** · 1156 Chesapeake Ave., Columbus 12, Ohio

It's a NASH Heating Pump, PLUS!



The type CSI NASH Heating Pump sets a new standard of economy

Now a Nash quality Vacuum Heating Pump can be economically installed and operated on any steam heating job. Engineered for high performance and low installed first cost, this new pump still makes use of time tested Nash principles of operation.

The Nash CSI has generous air capacity and features a wide choice of water capacities and discharge pressures. The right combination of capacities is at hand to match the requirements of the job. It is no longer necessary to pay extra for a pump with excessive water capacity, excessive discharge pressure, or in an attempt to get adequate air capacity.

With this advanced design, Architects, Engineers and Contractors will find answers to many heating system problems. Send for bulletin now.

1. ECONOMY IN FIRST COST
2. ECONOMY OF INSTALLATION
3. ECONOMY OF OPERATION
4. ECONOMY OF MAINTENANCE

NASH ENGINEERING COMPANY
449 WILSON, SO. NORWALK, CONN.

How Chicago's new exposition hall is heated and air conditioned

McCormick Place

By PHILIP M. DERRIG
Chief Mechanical Engineer
John Dolio & Associates
Consulting Engineers, and

LYMAN R. FLOOK
Superintendent of Building
and Grounds (Retired)
University of Chicago

• Chief architects for the mammoth new exposition hall and theater on Chicago's lakefront were Shaw Metz & Associates. Edward D. Stone of New York and John W. Root, Chicago, were consulting architects. Consulting mechanical and electrical design services were provided by John Dolio & Associates.

Mr. Flook was retained by the architect to coordinate the 1300 pages of specifications with the continuing changes that had to be made in the drawings for the structure. He later edited the extensive addenda to the original specifications.

YEAR 'ROUND air conditioning for the big new exposition palaces being constructed in various cities is a many-sided design problem. Generally, the first consideration is one of sheer size, since the halls grow larger as cities strive to compete with other convention centers.

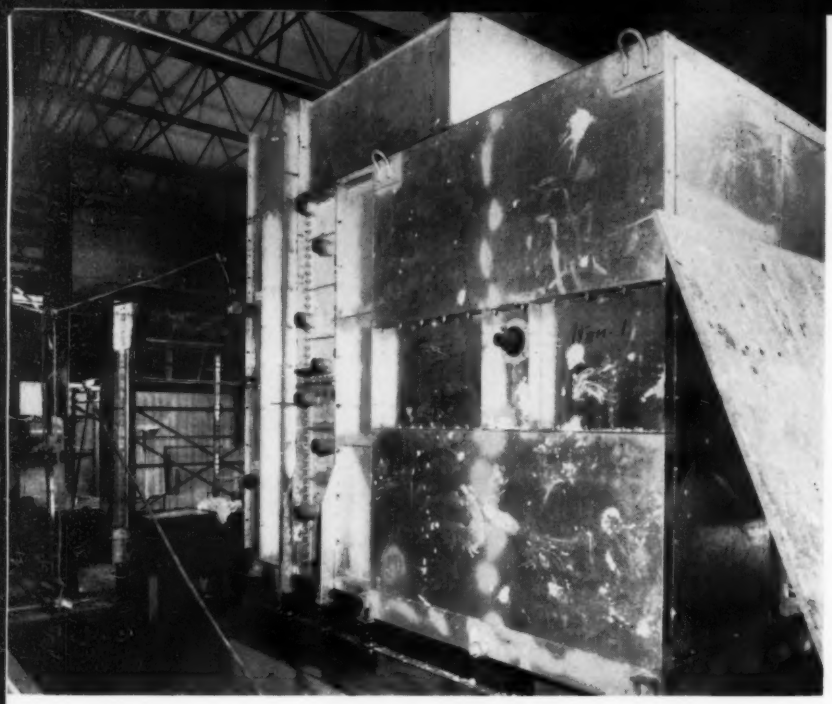
A closer examination reveals some other facets to the question. If the hall is to attract business for the city, it must be capable of accommodating a wide variety of exhibits and meetings, and more important, of handling several kinds of expositions, meetings, banquets, etc., at the same time.

Large open areas, extreme floor to ceiling heights, maximum access space between areas and to the outside, and provision for all of the various service areas further complicate the problem.

Finally, the very fact that the halls house expositions indicates the need for extreme flexibility in the air conditioning system, to maintain tolerable conditions while large numbers of people arrive, move about, and depart; and also during those periods when smaller shows and gatherings produce either a drastic decrease or increase on heating and cooling loads.

Problems Met in New Hall

McCormick Place, Chicago's new $35 million exposition center, is unique both for the size and char-



AIR CONDITIONING for 320,000 sq ft main exhibition area is supplied by 22 separate air handling units, each with cooling and heating coils, individual filter systems

acter of the facilities offered. The main area was recently opened. An integral theater will be ready for summer use.

Some general statistics will help establish the extent of the design. The building measures 1180 × 365 ft on three levels — from the top, a main exhibition area of 320,000 sq ft, beneath which is a floor devoted to meeting rooms, lobby, restaurants, and the theater access.

Two basement levels provide room for mechanical equipment and other service areas. The lobby level includes a vehicular tunnel which extends the entire length of one side.

At the south end of the structure, a 5000 seat theater with orchestra and balcony levels rises to a height equal to that of a 10 story building.

Air Condition Whole Building

All public areas are air conditioned for year 'round use, by dint of a large variety of systems and subsystems.

At the heart of the installation, four packaged horizontal fire-tube boilers, each rated at 600 hp and wtih a capacity of 20,700 lb of steam per hr, provide steam to remote converters and heating coils, for direct heating and for reheat in the cooling system.

To dispose of the expected large quantities of dry waste material from the exhibit area, dining rooms, etc., an 18 × 7 ft incinerator, almost 12 ft high, has been installed. The unit will handle up to 2000 lb of dry waste per hr. The incinerator is gas fired, and is constructed of 12 gage steel with a 9 in. fire brick lining separated from the outer shell by 2 in. insulation blocks. A spray-type gas washer is installed between the main combustion chamber and the roof exhaust flue to control emission to the outside air.

Adjacent to the boiler room, three centrifugal water chillers with a total capacity of 3750 tons are installed for cooling needs. Condensing water is readily available, since the center is on the shore of Lake Michigan.

A 36 in. intake pipe carries lake water to the condensers. The approximate design temperature rise of the condenser cooling water is 16.7 F. Temperature measurement of the lake water has shown that it is seldom warmer than 75 F. The three chilling units have a total capacity of 9000 gpm, reduced in temperature from 52 to 42 F, when supplied with condensing water at 6750 gpm, entering at 75 F and leaving at no more than 91.7 F. Condenser water is returned to the lake at a point 90 ft removed from the intake.

Zone Main Exhibit Area

The large exposition area on the top floor is entirely open except for the structural supporting columns placed 60 ft in from either side wall. Two expandable motorized "walls," which extend from floor to overhead beams, can divide this area into three large halls, or when withdrawn, preserve a single huge space.

Because separate areas on this level might be used for different exhibits, invite smaller or larger crowds, etc., a zoning effect was needed for proper environment control.

To accomplish this, 22 separate air handling units, each with fan and heating and cooling coils, are installed above the trusses. Each is supplied with outside air by means of a short duct directly to the roof. Supply ducts lead from the units and branch ducts

are taken off as needed to properly position the circular diffusers according to the zoning plan.

Low pressure steam from the boilers is supplied to heating coils and shell-and-tube converters. Cooling coils are supplied with chilled water from the central system.

Special provisions are made to isolate moving equipment vibration from the building proper. All large equipment is mounted on concrete pads with spring-type isolators.

For meeting halls, and in the theater areas where vibration elimination is particularly important, fans are mounted on concrete with spring limited to 1 in. static deflection. The concrete base for each fan is equal in weight to the weight of the equipment above it.

Each air conditioning unit is individually controlled by a combination outdoor, room, and discharge thermostat system through a central control panel.

Supplementary ventilation for the space between the roof and the acoustic treated ceiling is supplied by means of a gravity and power roof ventilator system, with fans and dampers also controlled through the central panel.

Use Individual Filter Systems

Each such air handling unit is equipped with its own filtering system. In most instances, electronic precipitators with fiber blanket roll type filters are used. Activated carbon filters are also installed for removing objectionable odors. This permits a large reduction in the quantity of outside air which is required, thus effecting a considerable saving in cooling and heating costs.

Solid Walls Reduce Loads

Another important factor in the design of the system is that, except for some areas on the lobby level, the structure is almost completely windowless. Cooling and heating loads are therefore substantially reduced. Calculated maximum cooling load is 48 million Btu per hr, and maximum heating load is 70 million Btu per hr. Exterior walls and the roof are designed to insure a maximum heat loss no greater than 0.20 Btu per hr per sq ft per F temperature difference. The roof is of poured gypsum with insulation backing, with an insulating ceiling of aluminum faced glass fiber tile above the roof trusses.

Precast concrete panels, 41½ ft high and 15 ft long are joined in the vertical plane to form the exterior walls. The panels consist of 1½ in. of expanded cellular plastic impregnated with CO_2 and sandwiched between 2¼ in. layers of light weight concrete.

Lower Level Has Double Duct System

One floor below the main exhibition area, the building facilities include 23 meeting rooms, art gallery, small theater, restaurant, administrative spaces,

CENTRIFUGAL COMPRESSOR room is located immediately adjacent to boiler room, contains three centrifugal chillers with total capacity of 3750 tons

and other service rooms. Since each of these areas might demand different conditions at the same time, a high pressure double duct system is installed.

The system requires two fan rooms, each with a 70,000 cfm capacity. Here the overhead consists of a false ceiling, dropped 12 ft from the level above. This space provides room for the air distribution ducts and service piping for the entire floor.

Mixing boxes are installed in each space, and are controlled by room thermostats. Outside air is introduced below the base floor level, to the fan rooms. Heated and cooled air is supplied to the mixing boxes via a duct system installed above the false ceiling. This high pressure system supplies all meeting rooms and some other public spaces on this floor.

Separate Office Cooling System

The administrative and service areas at this grade have packaged multi-zone units installed, so that conditioning operations for those spaces is independent of that for the public areas. Kitchens and rest rooms use 100 percent outside air, with separate exhaust fans.

Other separate systems on this floor, all employing packaged air conditioning units, include one for the small (500 seat) auditorium, and the art gallery. The latter unit has a capacity of 9000 cfm.

Tunnel Given Special Attention

The roadway through the building along its west wall is three blocks long, and is designed to furnish covered loading space for a maximum of 7000 autos in a 45 minute period.

Positive ventilation for the tunnel is obtained by means of a supply duct along the top of the outside wall, from which pairs of discharge outlets are tapped every 20 ft. Exhaust air is collected in a plenum along the east side of the tunnel, above the loading platform. Axial flow exhaust fans are used in the exhaust air system. Excess air is permitted to flow freely between the north and south openings of the tunnel.

Theater Has Low Pressure System

The great theater at the south end of the building will seat a total of 5000 persons — 3000 on the orchestra level and the remainder in a raised balcony. To accommodate any size show, the stage is 60 ft deep by 160 ft wide, with a 90 × 38 ft opening. Stage and seating areas were treated separately, but the two systems were designed to produce a proper balance when the curtains are raised and the spaces in effect become one.

Ventilation code requirements in Chicago are for 30 cfm per person. Therefore the 150,000 cfm capacity needed for the theater is provided by means of two fan systems, each of which fills half that requirement. These are installed one on either side of the auditorium.

Screens Hide Ducts

Because of the acoustical problem represented by so large a theater, decorative screens are used to cover the sound-reflecting walls and ceiling. The screens serve a double purpose, also hiding the branch ducts which supply conditioned air throughout the room. Terminal diffusers are placed above and behind the screens.

Each of the two systems is equipped with electronic, roll-type, and carbon-type air filters. Acoustic lining is used liberally close to the fan units, in order to reduce noise transmission to the very lowest possible point.

Return System Is Divided

The low air velocity needed for acoustic control is made possible by a separated system for return air. About one-third of the return air is relieved through openings in the seat-end stanchions at the sides of the theater, to an under-floor concrete return duct. A similar portion is taken out through side and rear wall grilles to a conventional return duct, and the remainder is relieved through ceiling grilles.

By this means, the air velocities can be kept low, with a resultant increase in comfort conditions, since the effect of the supply-return pattern is a flow of air from ceiling to seat level, thence to the floor return.

Two Fans Serve Stage

The stage area is supplied by two air handling units, each of 24,000 cfm capacity, which again are installed one on either side of the space.

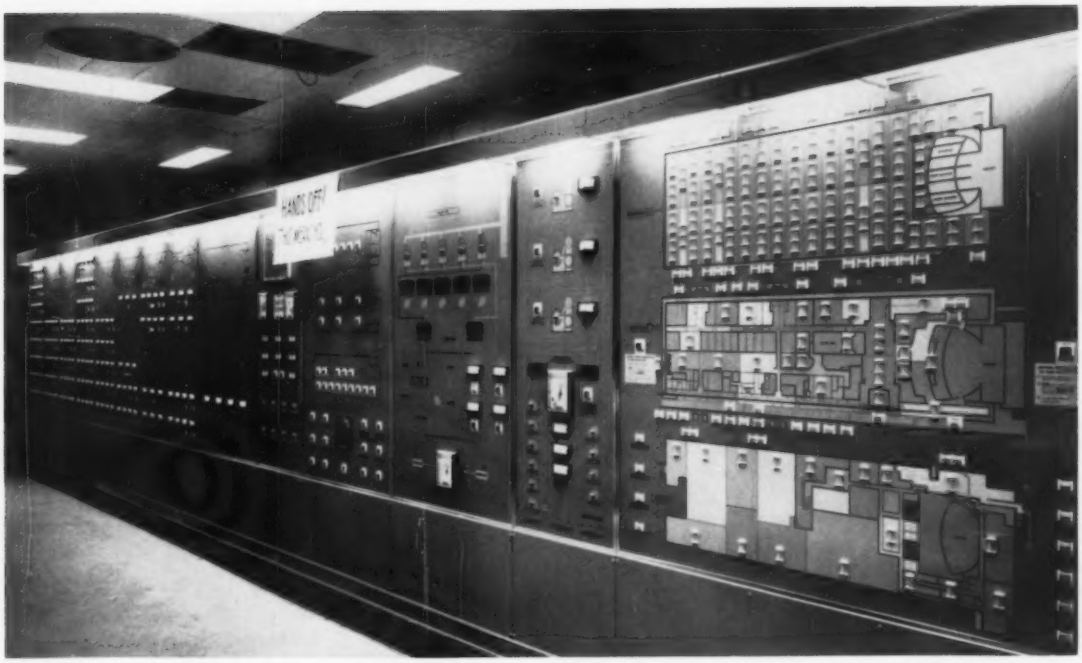
The chief problem in air conditioning a space such as this is generally humidity control. Proper control is obtained in the theater by exhausting that portion of the return air which enters the under-floor duct, to the outside.

Cooled and dehumidified makeup air is then supplied to replace the quantity lost.

Provide Exhibitor Services

An interesting feature of the hall is the provision made for the various services needed by the many exhibitors at their booths and displays in the main area.

More than 200 floor boxes are installed flush with the concrete deck. Within these boxes, connections are available for low pressure steam, water, and



CENTRAL CONTROL PANEL for all heating and air conditioning functions throughout building is located on ground level in view of public corridor

waste piping. For exhibits requiring exhaust facilities for removal of combustion gases, odors, etc., vents are installed beside each of the structural columns within the hall. Vent openings are approximately 10 ft above the floor. Risers carry the waste gases up through the roof.

The steel-column enclosures also serve the additional purpose of providing duct space for the return air system connected to the 22 air conditioning units above the area.

Piping Covers Wide Spectrum

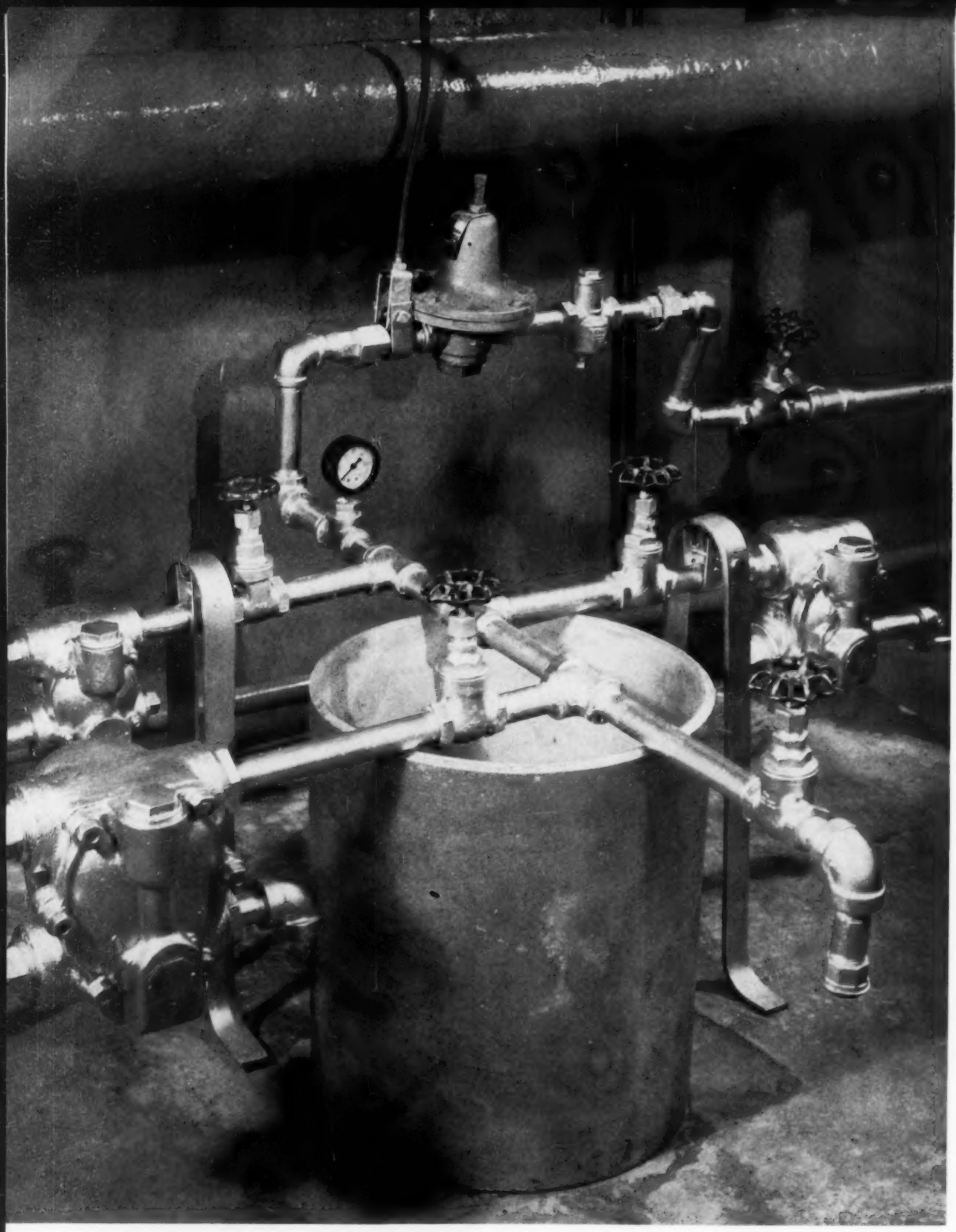
The kind, sizes, and fabrication of the piping systems needed for the job match the complexity of the project itself. Pipe 2 in. in diameter and smaller is butt welded; that larger than 2 in. is lap welded.

Black steel pipe, schedule 40, is used for steam supply and main steam headers, boiler leads and feed pump discharge lines, condenser water supply and return, and all chilled water lines.

Galvanized steel pipe, schedule 40, is used for cold water makeup, and overflow and drain piping. Fuel oil tank and condensate pump vents and underground fuel lines are of wrought iron. The principal exception to this list is that special steel pipe is used for some steam supply lines, in 10 gage thickness for 6 to 10 in. lines inclusive, and 8 gage for larger sizes.

Cover photo courtesy of Inland Steel Co.
Equipment photos by The Gibson Studios, Chicago

STRUCTURAL COLUMNS, now enclosed, provide space for return air system, vent pipe for exhibitors' use



1 TEST STAND for steam trap inspection uses 14 in. steel pipe as base, ¾ in. pipe for steam supply. Trap bodies are kept on stand for quick insertion of working parts. Diaphragm pressure reducing valve decreases 40 psi pressure to value needed for testing

By EWART H. BRADBURY
Air Conditioning Engineer
Liberty Mutual Insurance Co.

Annual Test Insures Proper Steam Trap Performance

WE HAVE found it good practice to service every steam trap in a heating system at least once each year. With this program, we have reduced the temperature of condensate returns in the Liberty Mutual Co. building from 190 F to 145 F.

This represents an annual savings of 18 to 20 percent in steam consumption, based upon the purchase of district steam. Slightly less savings would be realized on a system that has its own heating plant.

Trap Type Varies

Our system contains some 271 traps. These include float traps, thermostatic traps, and the float-and-thermostatic type. Each is tested every year to assure proper operation.

Among the troubles that arise from year to year, and which cause a trap to malfunction, are: the float ball becomes porous or splits; the port begins to clog; or the thermostat gets sluggish.

Service With Heat Off

Traps are checked during midsummer and early fall, when heating is not required. The time available between operation shifts of our air conditioning plant is used for this purpose. Approximately 30 minutes is required on the average to service each trap.

Trap covers are removed five or six at a time for convenience and are taken to a steam trap test stand, where they are tested individually. Each cover and body is permanently numbered to insure that a cover is returned to its proper body. Distortion of a cover may occur in service, and if it is not returned to the same body leaks may develop in the joint between cover and body.

Builds Own Test Stand

We have constructed a trap test stand on a design as shown in Fig. 1. It is important that the stand be rigidly constructed. In ours, a 16 in. length of 14 in. steel pipe is used to support the test piping. Legs of the test piping which branch out from the main steam line are welded in place to prevent the entire stand from moving.

A diaphragm pressure reducing valve is installed in the main line to reduce the supply pressure of 40 psi to whatever test pressure is required. A strainer is installed ahead of the pressure reducing valve to keep it free of grit and scale.

Use Standard Pipe Size

We use a $\frac{3}{4}$ in. pipe from the steam supply line and throughout the test stand. Larger trap inlets are reduced to $\frac{3}{4}$ in. When this is done, it usually takes a few seconds longer to fill the traps with steam.

A nipple and elbow, and a close nipple are installed on the outlet side of the trap, which is vented into a bucket. The stand could be open vented to a floor drain.

Trap bodies of every description in use are kept at the test stand so that time is not wasted in changing trap bodies for different cover sizes. An outlet is also provided on the stand for checking thermostatic traps and to test radiation that may be questionable or faulty.

Test At Design Pressure

It is important that a trap be tested at its design pressure. That is, if the trap is working at 5 psi, but is designed for a working pressure of 15 psi, it would be tested at 15 psi. A pressure gage installed downstream from the pressure reducing valve permits adjusting the test pressure to the required value.

When testing a trap, the unit must be cold when the test is begun. If the trap is hot, it must first be chilled to its normal starting position by immersion in cold water.

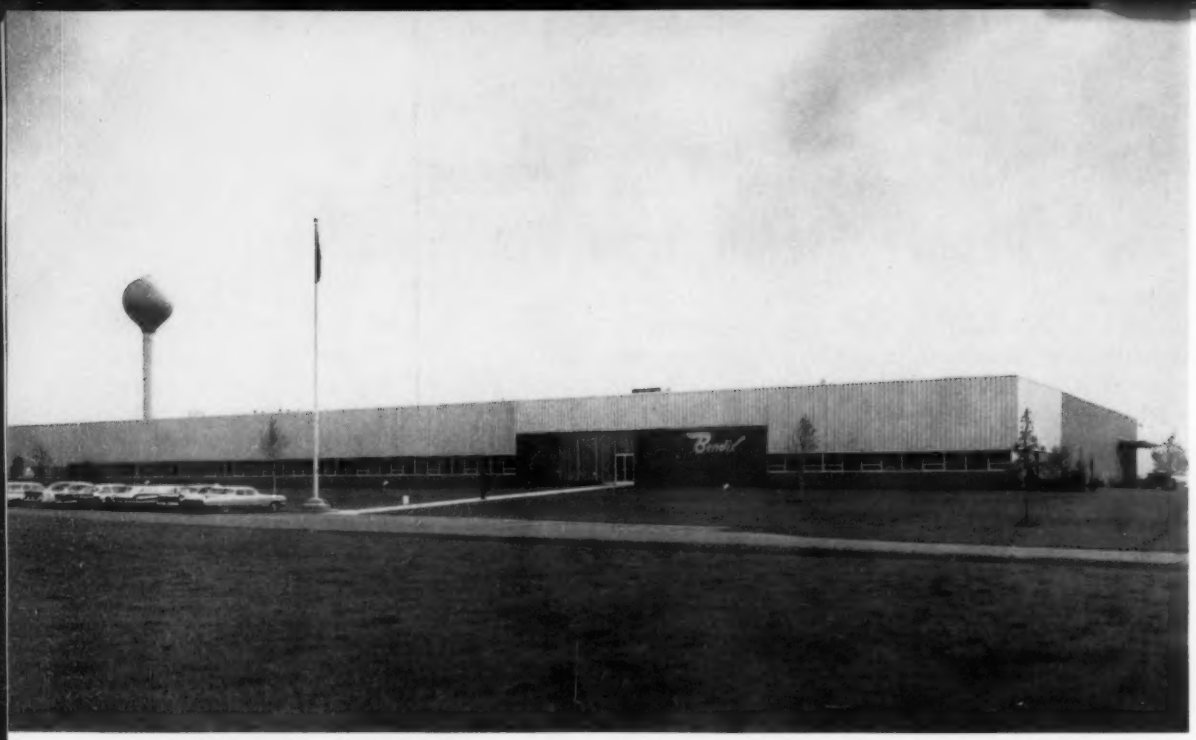
Describe Test Procedure

When the test valve is opened, condensate in the line will fill the trap. If a float trap is being tested and the float is functioning properly, the trap will open and discharge the condensate through the outlet. If the float is full of water because of a break or porosity, the trap will remain cold and condensate will not drain. Replacement of the float is indicated by this behavior.

For a float and thermostatic trap, the float is checked in the same way. When the thermostat is operating properly, it will shut off the flow of steam out of the outlet side of the trap soon after the float has closed the valve. If steam continues to vent from the outlet, a faulty thermostat is indicated and replacement is in order. Similar tests can be accomplished on all types and makes of traps.

Clean, Inspect Concurrently

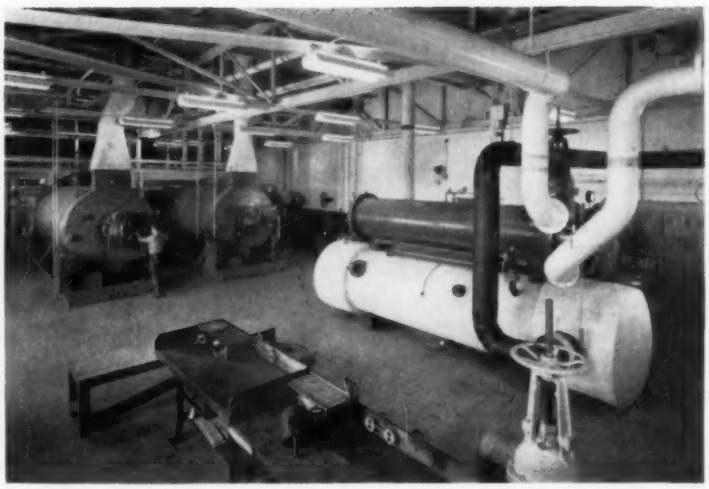
While the trap is disassembled, it is cleaned and other operating parts are inspected. A supply of spare parts is kept on hand to make all necessary repairs to the traps. The spare parts stock includes floats, thermostats, rocker arms, ports, bellows, and gaskets. ≠

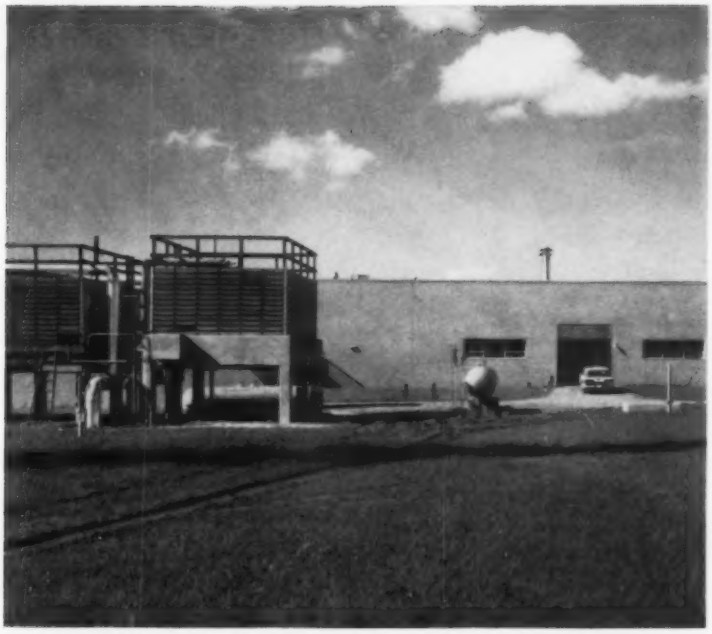


NEW SEMICONDUCTOR plant in Holmdel, N. J., designed and constructed for The Bendix Corp. by The Austin Co. contains 72,000 sq ft of floor space, 90 percent of which is air conditioned, excluding only areas such as shipping dock, mechanical equipment room, maintenance shop, toilet rooms, and certain process areas. Makeup air for plating and toilet rooms is taken from conditioned space. Nine air conditioning units, with total capacity of 150,000 cfm, provide cooled, heated, and filtered air to 65,000 sq ft of the pant area.

Air Conditioning for

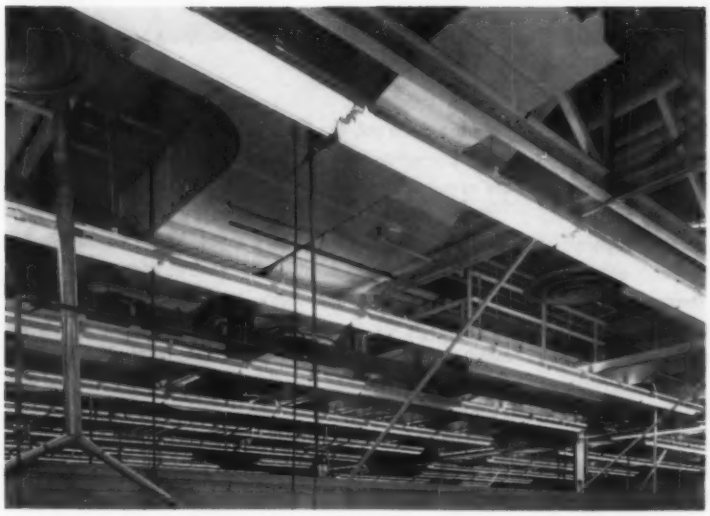
MECHANICAL EQUIPMENT is located in large space designed to handle future expansion, includes 500 ton capacity centrifugal refrigeration machine, two oil fired, 250 hp hot water generators. Hot water is delivered by means of four pumps with 300 gpm total capacity. Plant is heated by combination of fin tube convectors, unit heaters, cabinet heaters, and year 'round units. Heating coils in these latter units compensate for roof loss and handle makeup air requirements.



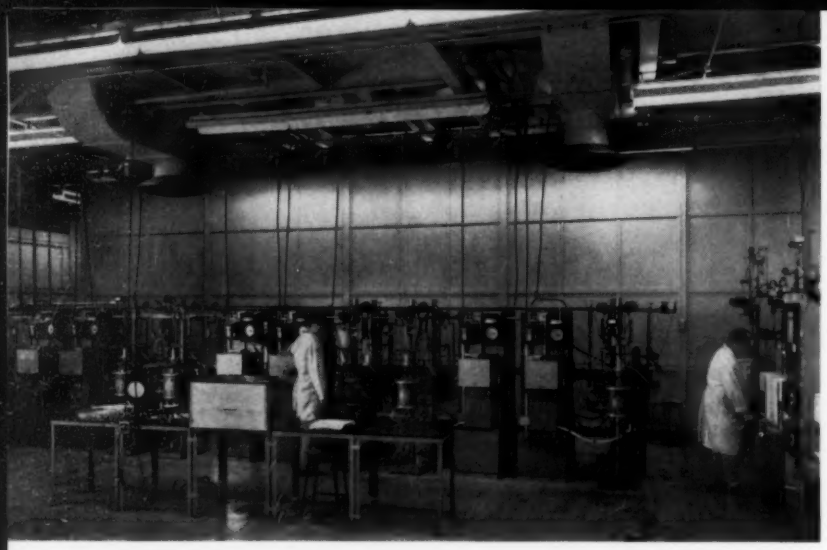


COOLING TOWERS for semiconductor plant are located directly opposite mechanical equipment room, entrance to which is visible in background. One unit provides 1600 gpm condensing water for centrifugal refrigerating machine, second tower and pump supplies 430 gpm process water. Propeller fan motors are two-speed for reduced capacity during winter, can be reversed for de-icing when temperature exceeds 40 F.

Light Industry



AIR HANDLING UNITS, ducts, and service piping have been installed above building trusses where platforms and walkways form integral part of building frame. Flow meters in each zone and in return connection from each hot water heating coil, reheat coil, and chilled water coil ease problem of balancing air conditioning effect throughout plant. Reheat provision is incorporated in all units serving manufacturing area. 85 percent of conditioned air is filtered electrostatically.



AIR DISTRIBUTION throughout manufacturing and laboratory areas is by means of overhead diffusers. Here, germanium crystals are grown in banks of furnaces at temperatures close to 1800 F. Conditioned air reduces possibility of contaminating highly purified element crystals.

PNEUMATIC TEMPERATURE CONTROLS regulate conditions in each working area throughout plant. Room thermostats and humidistats are coupled with night thermostats which can maintain heat in spaces during off shifts. Summer-winter switch for operation change and modulating control for return air dampers are also included, besides a low limit thermostat to halt fan when leaving air temperature is below 60 F. Multi-zone units are provided for smaller office areas.

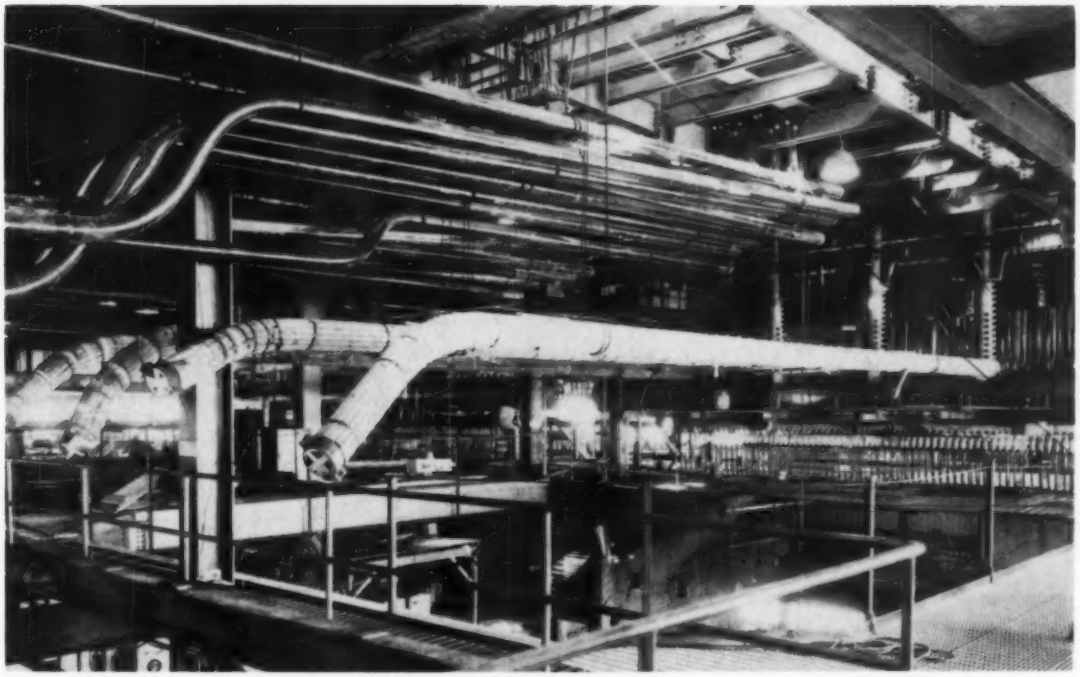
CHEMICAL LABORATORIES in plant are equipped with exhaust hoods connected to PVC ducts. Some, like this production chemical lab where fumes are highly corrosive, have both supply and exhaust ducts connected to hoods. Filtered make-up air from supply duct blankets perimeter of hood at volume great enough to prevent escape of any fumes. Exhaust ducts connect to roof outlets. Service and process waste piping is installed in covered floor trenches.

INTERESTING FEATURE of the plant is a 50 × 25 ft low humidity room in which process requiring extremely low humidity is carried on. Individual packaged air conditioner supplies cooled air 24 hr a day. 25 ton capacity reciprocating compressor is coupled with roof-mounted evaporative condenser for this system. Recirculated and outside air is directed through disposable filters, thence to dryer which uses silica gel as desiccant. Air then passes through electrostatic filter, through cooling coil, and is discharged to room.

Desiccant beds are constantly regenerated by means of exhaust air from a plant test area, which passes through hot water heating coil, thence to an electric heater to attain a temperature of 235 F. After picking up moisture from the silica gel, the air is exhausted to the atmosphere. Static pressures between moist and wet sides of the dryer are regulated so any leakage will be from the dry side.

Room temperature is controlled by stepping the reciprocating compressor in four stages, which unload in sequence. No low limit humidity control is required. A recorder monitors dry bulb temperature and relative humidity in the room, and gives visual signal when humidity rises above a predetermined level. The room is maintained at design conditions of 80 F in summer and 70 F in winter.

Walls, floor, ceiling, and all air ducts serving the room are equipped with vapor barrier to prevent moisture pick-up from outside spaces. ≠



TREND TOWARD SUPERCRITICAL high pressure-high temperature piping systems is evidenced at Philadelphia Electric Co.'s Eddystone Station. Here, conditions are 1200 F, 5000 psi on the No. 1 unit — believed to be more severe than those in any existing utility. Main steam lines are shown covered with protective wood lagging which was not removed, except at welding points, until insulation was applied

High Pressure-High Temperature Piping: A Transition in Engineering Design

By HENRY de SOTO
Mechanical Engineer

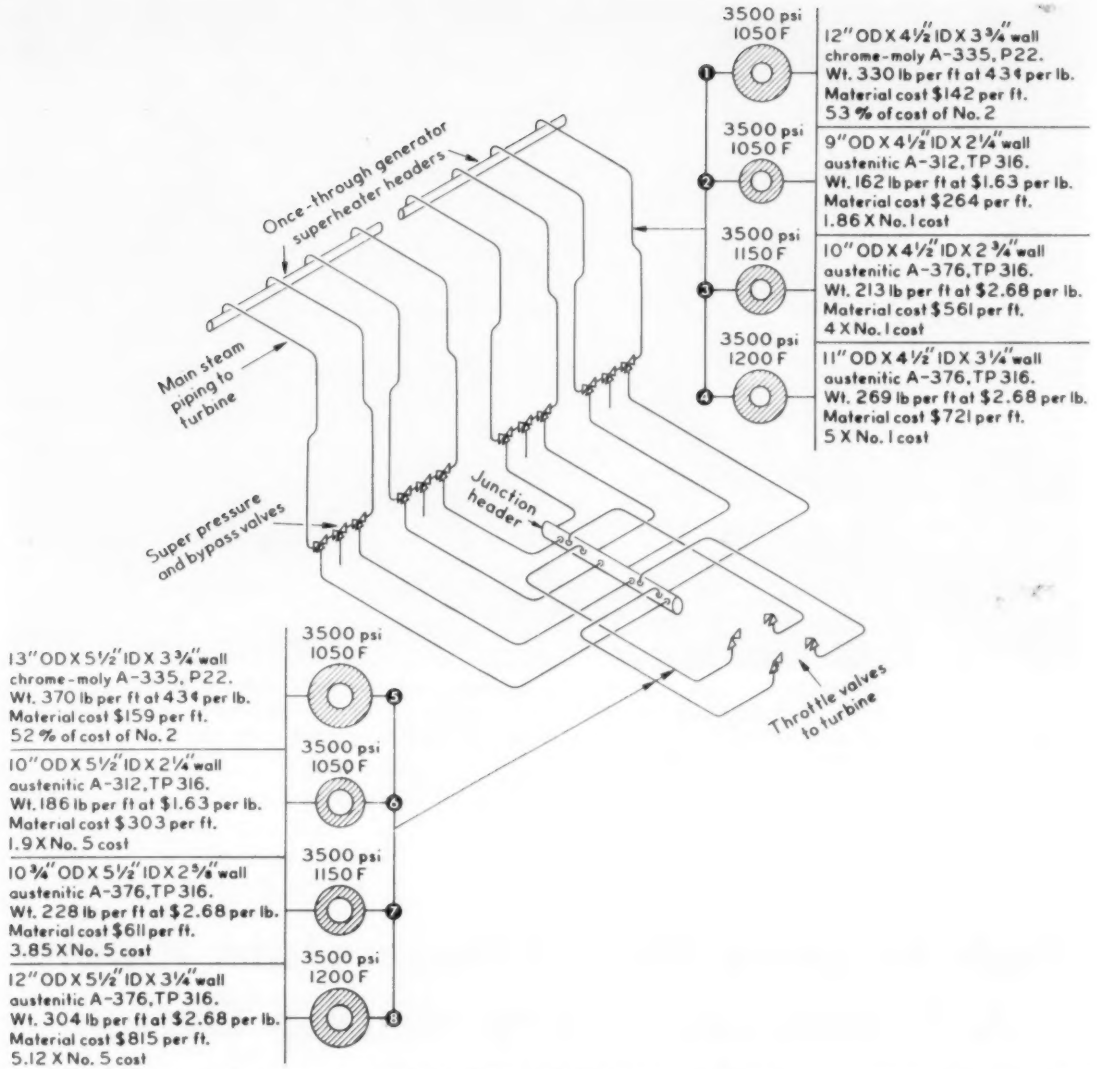
● **Recent years have seen a pronounced trend toward the use of steam at ever-higher pressures and temperatures. To keep pace with this need, piping technology in the subcritical and supercritical field has undergone rapid development. This article will outline some of the terminology of high pressure-high temperature steam piping, its materials and their correct applications, and its pressure-temperature relationships.**

Mr. de Soto has over 37 years in power piping design and engineering. His current duties as steam piping designer in the supercritical pressure-temperature area well qualify him as an authority in this comparatively virgin field.

IN THE PAST 25 years, the art of piping design has grown into a rather respectable science. In fact, it has achieved a high technical stature.

Since the start of the century up to about the second decade, design of piping systems was governed primarily by the thinly established requirements of the elastic behavior of the materials used. The 1920s ushered forth the need to reckon with pulsating loads, rising temperatures, increasing pressures. Pulsating loads, especially, brought challenging problems to metallurgists.

The entrance into the second


3500 psi
1050 F
12" OD X 4½" ID X 3¾" wall
chrome-moly A-335, P22.
Wt. 330 lb per ft at 43¢ per lb.
Material cost $142 per ft.
53 % of cost of No. 2
3500 psi
1050 F
9" OD X 4½" ID X 2¼" wall
austenitic A-312, TP 316.
Wt. 162 lb per ft at $1.63 per lb.
Material cost $264 per ft.
1.86 X No. 1 cost
3500 psi
1150 F
10" OD X 4½" ID X 2¾" wall
austenitic A-376, TP 316.
Wt. 213 lb per ft at $2.68 per lb.
Material cost $561 per ft.
4 X No. 1 cost
3500 psi
1200 F
11" OD X 4½" ID X 3¼" wall
austenitic A-376, TP 316.
Wt. 269 lb per ft at $2.68 per lb.
Material cost $721 per ft.
5 X No. 1 cost
Once-through generator superheater headers
Main steam piping to turbine
Super pressure and bypass valves
Junction header
Throttle valves to turbine
13" OD X 5½" ID X 3¾" wall
chrome-moly A-335, P22.
Wt. 370 lb per ft at 43¢ per lb.
Material cost $159 per ft.
52 % of cost of No. 2
3500 psi
1050 F
10" OD X 5½" ID X 2¼" wall
austenitic A-312, TP 316.
Wt. 186 lb per ft at $1.63 per lb.
Material cost $303 per ft.
1.9 X No. 5 cost
3500 psi
1050 F
10¾" OD X 5½" ID X 2⅝" wall
austenitic A-376, TP 316.
Wt. 228 lb per ft at $2.68 per lb.
Material cost $611 per ft.
3.85 X No. 5 cost
3500 psi
1150 F
12" OD X 5½" ID X 3¼" wall
austenitic A-376, TP 316.
Wt. 304 lb per ft at $2.68 per lb.
Material cost $815 per ft.
5.12 X No. 5 cost
3500 psi
1200 F

1 COST DIFFERENCES for several identical pipe lines designed for same pressure but using different materials for varying temperatures are outlined above

half of the century, 1951 up to the present, depicts a trend in piping design completely different from the past half-century's practices. Proper selection of materials and wise application to meet requirements should not be randomly entrusted to the inexperienced. Its exactitudes are many. Specialists should be in charge if safety of operation and efficient design are to produce satisfactorily with economy as a guide and good engineering as a result.

It is basic knowledge that all piping designs must comply with local and state regulations and codes. It is also well known that ASTM specifications and ASME codes are the guiding channels through which to draw the pressure piping systems as well as others less in significance but nonetheless important in exacting values.

It all appears at first glance rather highly complicated, but truly, when considering that codes and practices must allow for progressive and technological evolvements, the strictness of the codes and the exactness of the practices merely direct the engineers toward an economical, safe, and more advantageous way to further proper design.

Applications Aid Research

The rise of temperatures from 850 F up to the exacting 1200 F of the supercritical stages has created a wide field of metallurgical research and scientific application.

The most significant phases of high pressure piping selection, application, and choice are its proper manufacture, its proper usage, its efficiency, and its economical service.

In recent years, the use of carbon-molybdenum steel pipe was permitted up to 850 F. Failures due to graphitization and ruptures have wisely lowered its limitation to about the 750 F line.

From 850 to 1000 F, the selection of ASTM A-182, F11, and F22 forgings and P11 and P22 piping material (containing 1¼ percent chromium and ½ percent molybdenum; and 2¼ percent chromium and 1 percent molybdenum) have gained wide acceptance throughout. Above 1000 and up to 1050 F, the use of P22 and F22 has been followed to advantage. From 1050 to 1200 F, austenitic F316 and F347 have gained approval.

Operating pressures and temperatures are the two leading basic aspects upon which the proper pipe thicknesses and effectiveness of the alloying components are to be formulated and proportioned. A low alloy will suffice for high pressure and low temperature. A medium alloy will be needed to meet high temperature requirements without regard to low pressure. Hence, piping design has become a science.

Graphitization discoveries and laboratory investigations have resulted in the decision not to use carbon-moly steel pipe for service at temperatures above 850 F under any circumstances. Carbon steel has been judged unsafe at temperatures above 750 F.

The stainless steels present a rather interesting approach to high temperature requirements. Two major groups of these steel alloys are manufactured for commercial use. These are the chromium stainless steels and the chromium-nickel stainless steels (also known as austenitic stainless steels).

The chromium stainless steels are the martensitic (hardenable) stainless steels containing up to 14 percent chromium. Ferritic stainless steels contain 18 to 30 percent chromium.

Austenitic stainless steels are mostly employed for their corrosion resistance characteristics and for their high temperature suitability. However, these alloys present preweld heating and also some postweld stress relieving problems.

Another observation to consider when contemplating the use of martensitic and chromium stainless steels is the marked difference of thermal expansions as compared among themselves and mild steels. The austenitic steels have thermal expansions about 60 percent greater than mild steels. The chromium stainless steels have thermal expansions about 10 percent less than those for mild steels.

Determination of pipe wall thickness must take into account pressures, temperatures, and flow rates. The Pipe Fabrication Institute's technical bulletin TB-1953 on pressure-temperature ratings is a good guide to piping design.

Know the Language

The piping engineer should thoroughly acquaint himself with the metallurgical terms explaining piping and welding characteristics of different alloys. This knowledge is quite significant and helpful in his selection and use of materials to satisfy design requirements. In many cases his grasp of this phase of piping selection is a valuable assist to the many novice cadet and junior engineers selected by unqualified supervisors to direct engineering of many projects.

Creep. What is creep? This is a continuous plastic deformation of a metal under stress. It is associated with a time rate of deformation under a certain stress within the yield point for a certain temperature.

Yield point is the load per unit of original cross-sectional area at which a marked increase in the deformation of the specimen occurs without appreciable increase in load.

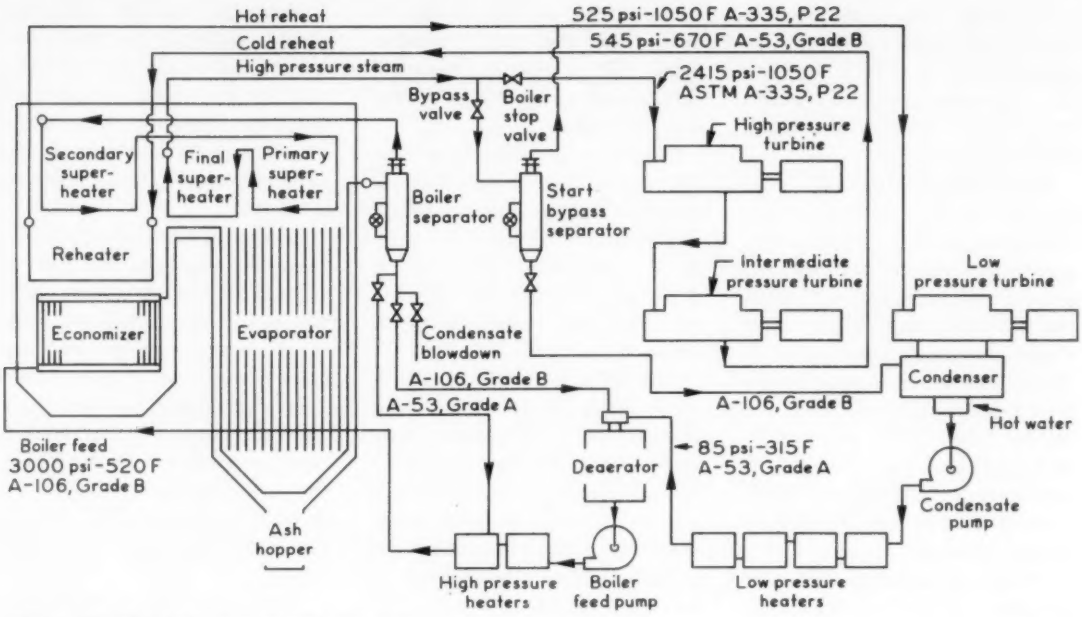
In metals, *fatigue* is the occurrence of progressive brittle fracture. It results, invariably, when ductility is impaired, as under too much stress. Another way to explain this phenomenon is that it is the tendency of a metal to rupture under conditions of repetitive cyclic stress at a point less than its tensile strength.

Thermal fatigue and *thermal shock* are terms denoting effects of temperature changes or varying exposures at high and low temperatures during the life of the material. When the severity of the temperature change is such as to cause the failure of the metal, thermal shock is the cause.

Tensile strength is the maximum strength that a material is capable of developing before rupture.

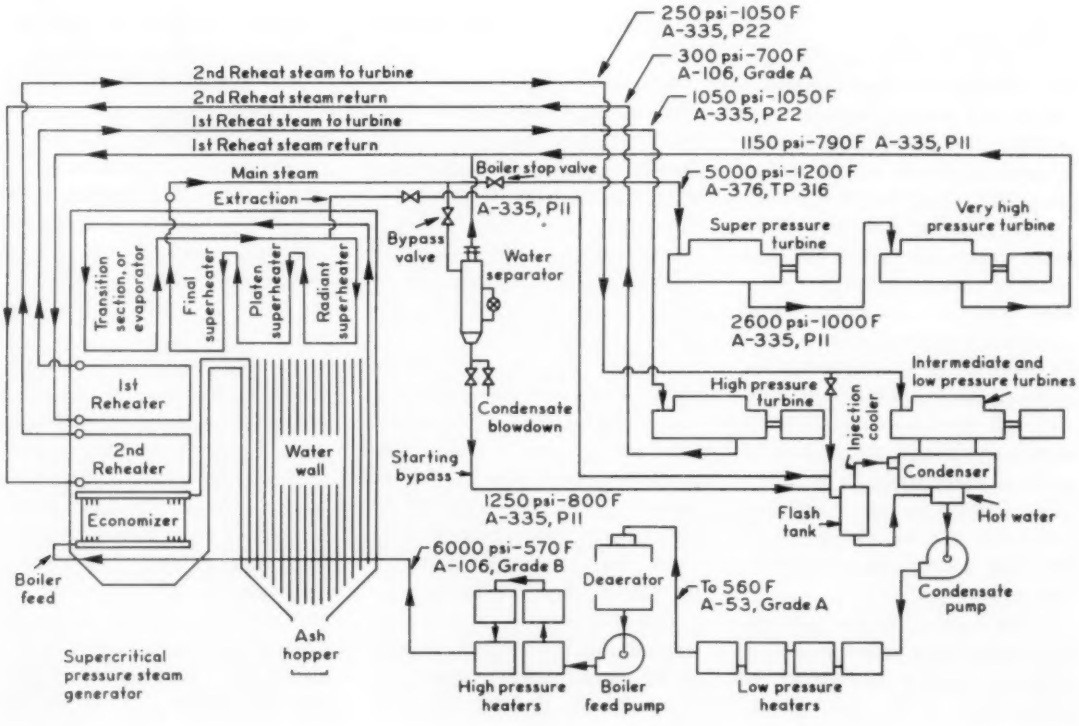
Ductility is the capacity of a metal to be permanently deformed in tension without breaking. It is also defined as the sliding of the crystal elements of the metal one upon another until satisfactory arrangement, or orientation, is attained. Materials under stress either (1) spring out of shape; (2) deform and yield to the external stress to deform, thus changing shape or form, or (3) fracture or fail.

A crystal is a microscopic entity consisting of atoms of the metal and atoms of carbon, plus alloying parts, plus undesirable parts. Molecular force holds these atomic parts together. Natural atomic forces hold these parts together in the crystal of steel, for instance. When under external forces too strenuous to resist, the metal ruptures. In rupturing, it is to be presumed that these forces give way like the mortar between bricks,



▲2 SUB-CRITICAL once-through steam system diagrammed above would be designed according to ASA, ASTM material selections as shown

▼3 SUPER-CRITICAL once-through steam system material selection below would compare with sub-critical, above, as shown by code & material numbers



like cement between mended parts.

Brittle failure. Some metals will fail under tension by disjunction of the crystals from each other. This often happens without warning and can occur over a wide temperature span.

Weld decay is the occurrence of intergranular corrosion next to a weld joint in the metal.

Intergranular carbide precipitation is a process by which steel becomes sensitized.

Sensitized stainless steel has been exposed to temperatures in the 900 to 1500 F range.

Graphitization is a phenomenon occurring in the weld zone of carbon and carbon-moly steels at about 700 F and up. It causes embrittlement of the weld zone, resulting in eventual failure under thermal shock or fatigue.

Stabilization is the addition of an alloy component to carbon steel to inhibit graphite formation.

Materials and Their Applications

The Code For Pressure Piping, ASA B31.1, governs the use and design of fittings and valves in pressure piping systems. The ASME Boiler and Pressure Vessel Code establishes jurisdiction over the parts connected integrally to the boiler, i.e., steam outlet, boiler feed inlet, safety valve, blowoff, gages, water column, sampling, and drain connections.

The American Society for Testing Materials, the American Society of Mechanical Engineers, and the American Standards Association have duly applied their extensive research and broad knowledge of the properties and usage of metals to correctly outline accurate selection and application of piping and vessels for the limits of pressures and temperatures through effective specification.

For temperatures up to 775 F, welding fittings and valve body materials must conform with the following specifications:

1) Cast carbon steel: ASTM A-216, Grade WCB.

2) Forged carbon steel: ASTM A-105, Grade 1, or ASTM A- 181, Grade 1 with carbon content not to exceed 0.35 percent.

3) Fabricated carbon steel parts: ASTM A-105, Grade 1, or ASTM A-181, Grade 1.

4) Flanged fittings and valves of cast carbon steel: ASTM A-95.

5) Flanged fittings and valves of forged carbon steel: ASTM A-105, Grade 1, or ASTM A-181, Grade 1.

6) The most acceptable piping material shall be seamless carbon steel. For sizes 8 in. and larger, ASTM A-106, Grade A or Grade B is recommended. Sizes 2 to 6 in. shall not exceed 650 F with use of ASTM A-53, Grade A or Grade B.

Temperatures between 775 F and 1000 F show the step up to the chrome-moly alloys of proportioned grades.

For welding end fittings and valve body material:

1) Cast nickel (0.8 percent) chrome (0.7 percent) moly (1 percent) steel: ASTM A-217, Grade WC5, or ASTM A-217, Grade WC6 with nickel deleted but containing chrome (1¼ percent) and moly (½ percent).

2) Forged chrome (1¼ percent) moly (½ percent) steel: ASTM A-182, Grade F11.

3) Fabricated steel parts: ASTM A-182, F11.

4) Flanged fittings begin to fade from usage at this temperature, but where used, cast chrome (0.7 percent) nickel (.8 percent) moly (1 percent) steel made to ASTM A-217, Grade WC5 is recommended.

5) Forged chrome (1¼ percent) moly (½ percent) steel: ASTM A-182, F11.

6) Fabricated steel parts: ASTM A-182, F11.

7) Piping material shall be seamless chrome (1¼ percent) moly (½ percent) steel: ASTM A-335, P11.

8) If fusion welded pipe is used, it should be chrome (1¼ percent) moly (½ percent) steel fabricated under ASTM A-155 from A-387, C plate.

The next ascending step, 1000 to 1050 F, denotes that for welding end fittings and valve bodies, the following should be used:

1) Cast chrome (2¼ percent) moly (1 percent) steel: ASTM A-217, Grade WC9.

2) Forged chrome (2¼ percent) moly (1 percent) steel: ASTM A-182, Grade F22.

3) Fabricated steel parts as (2) above: also of ASTM A-182, F22.

4) Flanged fittings, where used, should be of the same casting WC9 and forging F22 material.

5) Piping shall be preferably of seamless chrome (2¼ percent) moly (1 percent) steel ASTM A-335, P22.

6) Fusion welded pipe, when used, should be chrome (2¼ percent) moly (1 percent) steel fabricated under ASTM A-155, from ASTM A-387, D plate.

For temperatures between 1050 and 1100 F, welding end fittings and valve bodies require either of two alloys: (1) Cast chrome (2¼ percent) moly (1 percent) steel, ASTM A-217, grade WC9; and (2) cast austenitic stainless steel, chrome (18 percent) nickel (9 percent) moly (2½ percent), ASTM A-351, Grade CF8M.

In the forged category:

1) Forged chrome (2¼ percent) moly (1 percent) steel: ASTM A-182, F22, and

2) Austenitic stainless steel, chrome (18 percent) nickel (8 percent) moly (3 percent): ASTM A-182, F316 are according to code standards.

3) Fabricated steel parts follow the above alloy classes.

4) Piping material must be seamless chrome (2¼ percent)

moly (1 percent) steel: ASTM A-335, P22, and

5) Austenitic stainleess steel, chrome (16 percent) nickel (13 percent) moly (3 percent): ASTM A-376, TP 316.

For temperatures above 1100 F, welding end fittings and valve component parts will be under the following specifications:

1) Cast austenitic stainless steel, chrome (18 percent) nickel (9 percent) moly (2½ percent): ASTM A-351, Grade CF8M, and

2) Forged austenitic stainless steel, chrome (18 percent) nickel (8 percent) moly (3 percent): ASTM A-182, F316.

3) Fabricated austenitic steel parts when needed must comply with the above.

4) Piping material must be austenitic stainless steel, chrome (16 percent) nickel (13 percent) moly (3 percent) ASTM A-376. TP 316 for these temperatures and pressures.

What About Pressures?

The code and standards committees of the ASME have worked out certain acceptable allowable stress margins for materials to be used for valves, fittings, and pipe. These have been developed per the boiler code, the presssure piping code, and the American Standard for Pipe Flanges and Flanged Fittings. The allowable stresses permitted by the codes are based on the properties set by ASTM.

However, the chemistry and physics of the materials are of outstanding significance in their selection for usage by these bodies.

Piping pressures have required pipe thicknesses of acceptable standards as per the boiler code (in 1959), the power section of the piping code (in 1955), and ASA dimensional standards B 36.10 (in 1959). The 1955 pressure piping code formula:

$S = 20{,}000/[D/(t_m - C) - 2y]$

for S = 10,000 is used for ferritic steels at 950 F and below, and also for austenitic stainless steels at 1100 F and below.

where:

P = allowable stress in material due to internal pressure at operating temperature, psi

D = nominal size of pipe

t_m = minimum wall thickness, 87½ percent of nominal wall thickness

C = allowance for corrosion (0.05 in. for 1 in. pipe and smaller; 0.065 in. for larger sizes)

y = a coefficient having values as follows:

Temperature, F	Ferritic	Austenitic
to 900	0.4	0.4
950	0.5	0.4
1000	0.7	0.4
1050	0.7	0.4
1100	0.7	0.5
1150 and up	0.7	0.7

For ferritic steels at 1000 F and above and for austenitic stainless steels at 1150 F and above, the same formula applies.

The Pipe Fabrication Institute technical bulletin TB1-1953 contains this information worked out to acceptable pressure-temperature ratings.

The design engineer must, therefore, abide by the established rules of good practice and proper usage and must also conform with good judgment as far as economy and efficiency dominates selection of materials.

The Supercritical Trend

The recently recognized value of the once-through type of boiler for supercritical steam pressures presented new exigencies directed toward alloy steel pipe, valve, instrument, and specialty manufacturers. First, the requirements became obnoxious since costly and tedious research and experiment would result in costly products due to limitation of quantities needed. Second, the limited quantities needed for the few applications would necessitate bypassing production of other materials.

Quite often this dilemma has brought cases where refusal to quote has appeared as a wise decision on the part of manufacturers.

Yet, the advent of supercritical pressure requirements demanding attention is inevitable.

Studies as to standards for fittings, valves, and piping must, of course, progress satisfactorily.

Some valve manufacturers have been able to triple the maximum pressure limits for which their valves can be used by judicious alloy selection. They provide for heavy wall thicknesses to meet excess pressures and plasticity for excess temperatures.

Let us not overlook the fact that pipe standards over Schedule 160 are not yet fixed. Therefore pipe materials with, say, 20,000 psi fiber stress and with a stress ratio of 0.5 will provide usage for pressures of 5000 psi. But to provide positive assurance of service, most piping ordered for supercritical pressures is forged and bored, or some other specially chosen method of manufacture is used.

A study of the steam piping temperatures in Fig. 1 reveals a trend of thought based on acceptably conservative heat rate and performance blended with sober economic choice of material. Several utilities are deciding on 3500 psi steam generator and turbine units.

This pressure lies just about 300 psi above the critical edge, yet the advantages of applying the 1100 F to 1200 F temperature range has been negated by the economics of material cost and usage requirements. Therefore, the 1050 F temperature limit for 3500 psi steam has won its economic preference.

1050 F May Be Limit

At 1050 F, either chrome-moly material or austenitic stainless steel can be used. Costs predicate on chrome-moly. The cost of 316 stainless steel types required for 1150 F and 1200 F is rather prohibitive. The thicknesses of material, exacting forging and boring, and costly welding techniques contribute to its uneconomic usage. It results ostensibly that the 3500 psi and 1050 F barrier will prevail for the new once through supercritical units. ⧺

Chart Gives Dust Control Air Flow Rate For Receptacle, Bag Filling Operations

By CLYDE F. METZLER
Chief Engineer
National Technical and Scientific Co.

IN INDUSTRIAL operations which involve receptacle or gravity-bag filling with dust producing materials, it is necessary to compute the air flow rate required to control the dust. This applies to installations where an exhaust duct system is employed to restrict the contamination of surrounding air from the filling operation for bags, barrels, etc.

The accompanying nomograph permits easy computation of the exhaust rate needed to control the dust formed by such operations.

The chart is based on the equation

$$F = 1.5VA$$

where

F = required air flow rate, cfm
V = air velocity, fpm
A = open area of receptacle or bag, sq ft

The proper air velocity used to control the particular dust generated would be a matter of engineering judgment and experiment, based on averages included in standard texts.

This chart is valid for all industrial installations where it is desired to control dust transmission during the filling of containers of any type.

Example 1:

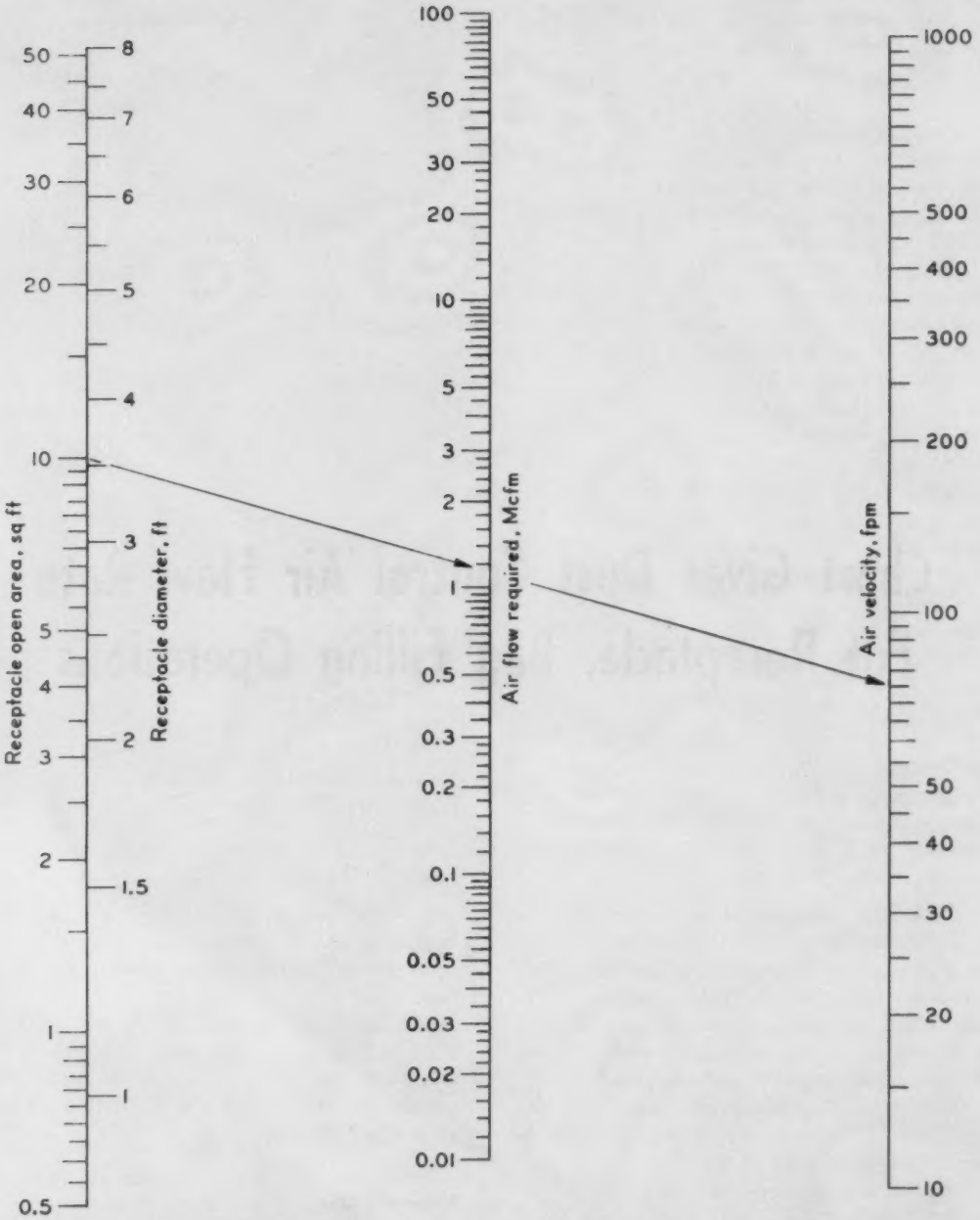
Determine the air flow required to control dust originating in a receptacle with a diameter of 3.57 ft, if the air velocity in the collecting duct is 75 fpm.

Solution: Enter the chart on the left at 3.57 ft diameter (10 sq ft open area) and draw a line through the air velocity 75 fpm on the right. At the intersection with the central scale, read the required air flow as 1125 cfm.

Example 2:

What air flow rate is required to control dust originating in a 2 ft diameter barrel if the air velocity in the collecting duct is 100 fpm?

Solution: Enter the chart on the left at 2 ft diameter (3.14 sq ft open area) and draw a line through the air velocity of 100 fpm on the right. At the intersection with the central scale, read the required air flow rate as 472 cfm. ∓



NOMOGRAPH allows quick computation of air flow rate (cfm) required to control dust formed in filling barrels, bags, other receptacles when diameter of receptacle, velocity of exhaust air in dust control duct are known

CENTRAL HEATING plant for downtown Chicago campus of Northwestern University is located in midst of residential district, yet offers no offense to neighbor's sight, hearing, or sense of smell. Tall smokestack enclosure is attached to adjacent dormitory building

Urban Central Heating Plant Controls Smoke, Dust, Noise Automatically

IN THE HEART of Chicago's elite Gold Coast residential district, centered on the downtown campus of Northwestern University, is a coal-burning heating plant with no apparent smoke stacks emitting billowing smoke to mark its location. No coal dust or soot can be smelled or seen settling on the neighborhood. No din of coal or ash handling and dumping can be heard.

Located just a few ft on the west side of the Abbott Hall student residence building, the plant gives only two external clues to its identification: its near lack of windows (there are only a few at street level) and its tall rectangular 200 ft tower.

This tower houses — or rather hides — the three 5 ft diameter smokestacks. Three breechings from the boiler house to the stacks are hidden in a limestone bridge at the second floor level.

How It Happened

On April 12, 1958, 14 months after ground was broken, the first truck-load of coal was delivered to this new 2½ million dollar plant. However, its history goes back five years. In 1954, university authorities recognized that something had to be done with the existing plant. At the time, the university was planning additional buildings as part of its overall expansion program for the Chicago campus.

The increase in steam load represented by the

• The new coal-fired heating plant which serves the various buildings of Northwestern University's downtown campus is located within an elite Chicago residential district, yet the surrounding neighborhood is unoffended by sight, smell, or touch. Coal proved to be the most economical fuel for the particular needs of the campus, and extensive design features eliminated the possibility of noise and air pollution nuisance. All fueling, combustion, and ash disposal operations are carried on within a single dust-tight building, identifiable only by its lack of windows and a tall rectangular enclosure for the smokestacks. Completely automatic operations carry the coal from truck to boiler and back to trucks as ashes. The plant has an annual production of 300 million lb of steam.

proposed buildings would require all the standby capacity of the existing plant — a situation that could not be tolerated if continuous service was to be provided at all times to the hospitals on the campus.

Accordingly, consulting engineers made a preliminary study and, in October 1954, reported their findings.

Compare Plants, Fuels, Costs

The survey confirmed that coal handling equipment in the existing plant was obsolete, noisy, and dusty. Physical limitations of the building made it impractical to replace the equipment with a similar but modern system in the same space.

Ultimately, various alternatives for the expansion of steam generating facilities were presented by the engineers, including conversion of the plant to oil firing with added capacity, building a new oil fired plant adjacent to the existing one, or construction of a new coal fired plant elsewhere on the campus. Whichever plan was adopted, the system would have to provide for an approximate maximum hourly steam demand of 97,000 lb of steam, of which about 80,000 lb would serve existing buildings and the remainder the contemplated new construction. Standby capacity, of course, had to be added.

The following cost estimates were submitted relative to the three alternatives:

For expansion of the existing boiler plant to the needed capacity of 100,000 lb of steam per hr plus standby, and conversion of the system to oil firing — a total of $600,000.00, of which $570,000.00 would be expended for mechanical work.

For construction of a new oil-burning plant adjacent to the existing facility, $560,000.00, not including the cost of the new building.

In considering the construction of a new coal fired plant elsewhere on the campus, sub-alternatives were included.

a) The cost of a complete plant with two 75,000 lb per hr and one 25,000 lb per hr boilers would be approximately $1,330,000.00, building included.

b) Future replacement of the smaller unit with a third 75,000 lb per hr boiler would add $270,000.00 to the cost.

c) A fourth unit of the same size added to meet future demands would cost about $395,000.00, including the cost of building expansion to accommodate the added equipment.

One added benefit which would accrue with the adoption of a new-plant plan was the additional classroom space to be gained when the old system in the university's Wiebolt Hall was abandoned. Then of course, building would permit installation of modern, more efficient equipment.

Estimates Lead to Final Plan

An extension of the cost estimates quoted here brought the designers to the ultimate plan, which incorporated the construction of an entirely new coal burning system, housed in a separate building designed for the purpose.

Three boilers were specified and installed. Two of these are 2-drum, water-wall boilers with traveling gate stokers, each rated at 90,000 lb per hr. The third is an oil-fired, water-tube packaged generator with a capacity of 40,000 lb of steam per hr. The area in which it is installed will accommodate a third coal fired boiler of the larger size should future demands require it. In the meantime, maximum demands are met, adequate standby capacity is provided, and the split-fuel system gives a flexibility and independence for operation which is much to be desired.

Modern Design Gives Automatic Control

Design pressure for the system is 175 psi. The principle load upon the plant is for heating.

Coal and ash handling systems for the new plant are completely automatic, dustproof, and silent. The terminal point for the ash handling system is in exactly the same location as the starting point for coal handling — within a passageway located inside the building along an outside wall, wide enough for even large trailer-trucks to pass through. The passage runs the width of the building, is separated from the main boiler room, and has overhead steel doors at both ends. Thus coal unloading and ash loading are carried on behind closed doors, and no dust or noise can leak either to the outside or to the boiler room proper.

A 25 ton receiving hopper in the center of the passage, topped by a steel grating, allows a truck of that capacity to unload and depart within three minutes. Immediately behind the hopper is the overhead ash discharge chute. Thus, ash loading is performed with equal efficiency.

Coal and ashes are also in close proximity in an overhead storage bunker. The bunker is catenary in shape and is located just below the 4th floor level. A 90 ft coal section runs the length of the firing aisle at right angles to the boilers. The ash section extends in the opposite direction for 19 ft.

A three day supply, or 600 tons, of coal is maintained in this first bunker. The ash bunker is closed at the top with a concrete slab and holds ashes from about a week's operation.

Coal Handling System Split

Coal is handled by two systems; the first from the receiving hopper to the overhead bunker, and the second from the bunker to the boiler scales. The first system is designed for up to 70 tons per hr. The receiving hopper is sloped to a 30 in. feed conveyor with a continuous slot along the full length of the track. A slide gate regulates the coal ribbon being fed out. This feeder discharges to a bucket elevator which carries the coal above the fourth floor level to discharge through a chute to a 24 in. belt conveyor running the full length of the bunker. An automatic self-propelled tripper transfers the coal from conveyor to bunker.

Second System Works Two Ways

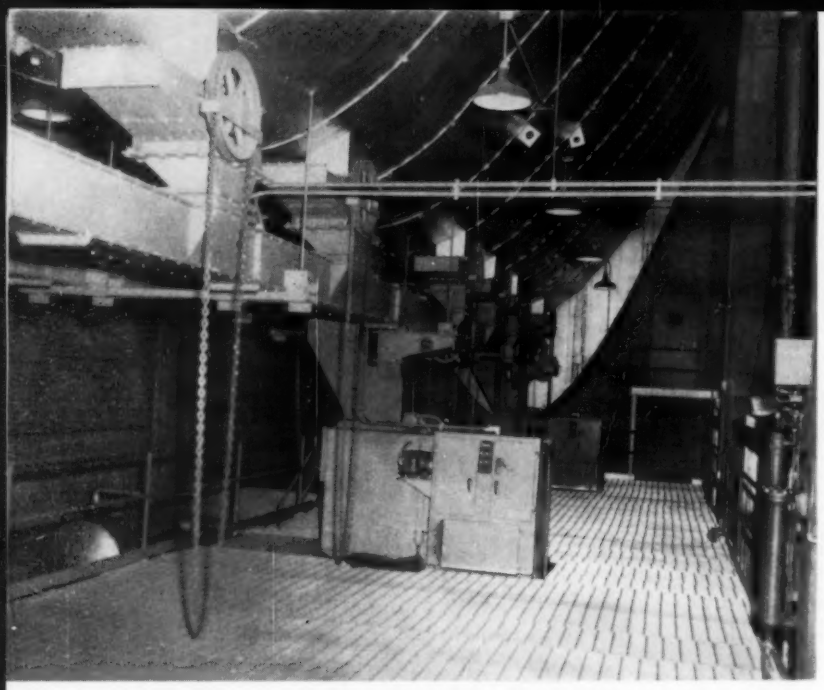
From the bunker, coal can be transferred to the coal-scale inlet hoppers by either of two methods. When the supply is drawn from that part of the bunker which is immediately overhead, it is transferred by one of three 18 × 18 in. discharge gates.

If the area over a scale is empty, a conveyor is used to transfer coal from another part of the bunker. The conveyor is fed through 10 inlet gates and discharges through four 8 × 24 in. gates; one for each boiler scale and another which leads to an outside dump chute. All 14 gates are of the rack and pinion type and are dust-tight. Flexible rubber connectors and rubber-in-shear mountings isolate vibration from the inlet openings.

The horizontal conveyor feeding the scale hoppers is located about 2 ft below the bunker and includes two 90 degree bends at each end to form a closed circuit. Each scale has a capacity of 15 tons per hr, is dust-tight, and is supported by vibration isolation mounts on the building structure. Coal weight is recorded as it passes through to nonsegregating conical hoppers, thence to the stoker hoppers. An audible alarm system is coupled with a gravity bypass arrangement to prevent interrupted flow.

All components of the coal handling system can be controlled from a centrally located panel, which also incudes start and stop buttons for all other equipment in the plant. Start-up of the apron feeder, bucket elevator, and belt conveyor is sequenced so that down-stream units must start first.

FIRING AISLE for campus heating plant includes two 90,000 lb of steam per hr boilers at center and rear, oil fired packaged steam boiler to right. Doors at rear lead to inside truck passage for coal and ash handling



CATENARY-SHAPE bunker receives coal directly from trucks, transfers it by means of conveyor to scale inlet hoppers. Weight is automatically recorded as coal passes through to stoker

A steam-jet pneumatic conveying system carries all material in a dry state to the ash storage bunker by induction. From there, a dustless ash unloader fills the trucks in the passageway described earlier.

The system, which has a capacity of 12 tons per hr, pulls ashes from the ash pit and fly ash arrestors, and siftings from the siftings hoppers.

Ash pits for each boiler are dust-tight and have two water cooled vertical lifting doors for ash removal. Intakes are connected to an 8 in. line.

Each fly ash arrestor has two outlets to which 8 × 12 in. expanding outlet pipes are connected. These lead to 12 in. air-operated soot intakes, then to a 6 in. ash pipe. Boiler siftings hoppers have 8 × 12 in. expanding outlet pipes, leading through a 12 in. hand operated soot intake to a 6 in. pipe.

Both the 6 and 8 in. ash pipes run parallel to the boilers and lead to a common 8 in. header, installed perpendicular to the branches. The header connects to an 8 in. riser, which carries above the fourth floor level to an ash receiver and secondary separator. The base of the receiver-separator forms a dust-tight connection with the concrete top of the bunker.

Wash, Filter Surrounding Air

Dirty conveying air is piped through a 12 in. line to a steam-operated multiple-jet venturi exhauster. From there, the air is passed to an air washer which is equipped with tangential water spray nozzles and spray arrestors. The air washer exhaust head leads from the top of the unit through the roof to exhaust to the atmosphere. Such an arrangement serves to silence the steam-air mixture emitted to the outside of the building.

A three-bag air filter is installed between the ash bunker and the atmospheric relief outlet. Dust and dry ash are filtered from the air passing from the bunker to the outside.

At the bottom of the ash bunker, a flanged discharge opening is connected to a feed hopper, which in turn leads by expansion joint and adjustable feeder to a revolving-drum dustless unloader. This unit conditions the ashes uniformly by spraying water over the drum contents as it revolves. A four-sided counterweighted chute receives the ashes for transfer to trucks.

Master Panel Affords Control

The complete ash disposal system is controlled through a wall mounted panel located opposite No. 1 boiler. Start and stop of the electro-pneumatic control system is initiated from this panel, and in addition remote push button stations with pilot lights are located between boilers. The system is interconnected through automatic timing devices, and includes a device to prevent operation when no water is flowing to the air washer.

A high velocity precipitator is installed in each boiler breeching. Smoke density is measured and recorded by an electronic system, also located in the breechings. A recorder operates an alarm when smoke density rises above a predetermined level, and maintains a permanent record of density at all times. Conical shapes installed atop the smokestacks increase the discharge velocity. Thermocouples located at the stack tops measure the flue gas temperature to insure efficient operation.

Holabird, Root & Burgee were the architects for the plant building. The consulting engineering firm of Neiler, Rich & Bladen designed the system. Phillips Getschow Co. was the heating, piping, and air conditioning contractor. ⧺

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally on practical problems in the field.

Sam Lewis says:

"Draft Head Is Important For All Thermally Circulating Convectors"

WE HAVE encountered an installation with insufficient room heat delivery by hot water radiators and convectors. As is usual in modern buildings, the architect had substituted glass for a more effective heat barrier such as masonry or insulated metal in the perimeter walls.

The contractor, in all innocence, installed horizontal single steel tube baseboard radiation units as convectors. These had 4 in. conventional steel flanges encased in metal covers.

The rooms with these heating devices did not become even reasonably warm, even though the designed equivalent area of heat transmitter was installed. The units were placed along the perimeter wall beneath the windows.

The manufacturer's catalog and the research that had determined the rating implied that room air must circulate freely, by thermal influence, around the heating surface. The catalog demanded a vertical clearance of at least 4 in. along the length of the heater, below the bottom of the unit or between the bottom of the encasement and the heater, for air circulation.

Unfortunately, the contractor, influenced by the architect in seeking to gain a greater clear glass area, allowed an air inlet clearance below the heater of but 1 in., instead of the minimum 4 in.

It is reasonable to believe that the rate of heat transfer into the room was reduced by perhaps one-fifth by this reduction of air way.

After increasing this clearance for thermal air flow, enough additional heat was accepted by the room to end the complaint of under-heating.

Difficulty with temperature control may be expected in any building that employs thermal air circulation if one area has radiators while another has radiant coils in the floor, ceiling, or wall of the structure.

This episode emphasizes that draft-head is important for all thermally circulating room heaters.

I remember one building in which all of the old cast iron wall radiators were installed directly against the outside wall, without any air flue between them and the wall.

After they were moved out so as to permit air flow behind them, the trouble ended.

Engineers and contractors have lived through the popularity of radiant heating by warm pipes in floors, ceilings and walls of rooms.

It is difficult to find enough area for sufficient heat-transmitting radiant type pipes in corner rooms, or in any rooms that have unusual heat demand.

One pretentious mansion equipped with hot water pipes built into the floors was recently abandoned as a residence and converted to use as a manufacturing plant, with heating by mechanically circulated warm air.

It became necessary in another dormitory type building, heated by underfloor radiant hot water pipes and endured for 10 years with too-cool corner rooms, to repipe the supply and return mains so as to assure circulation of especially warm water to those rooms.

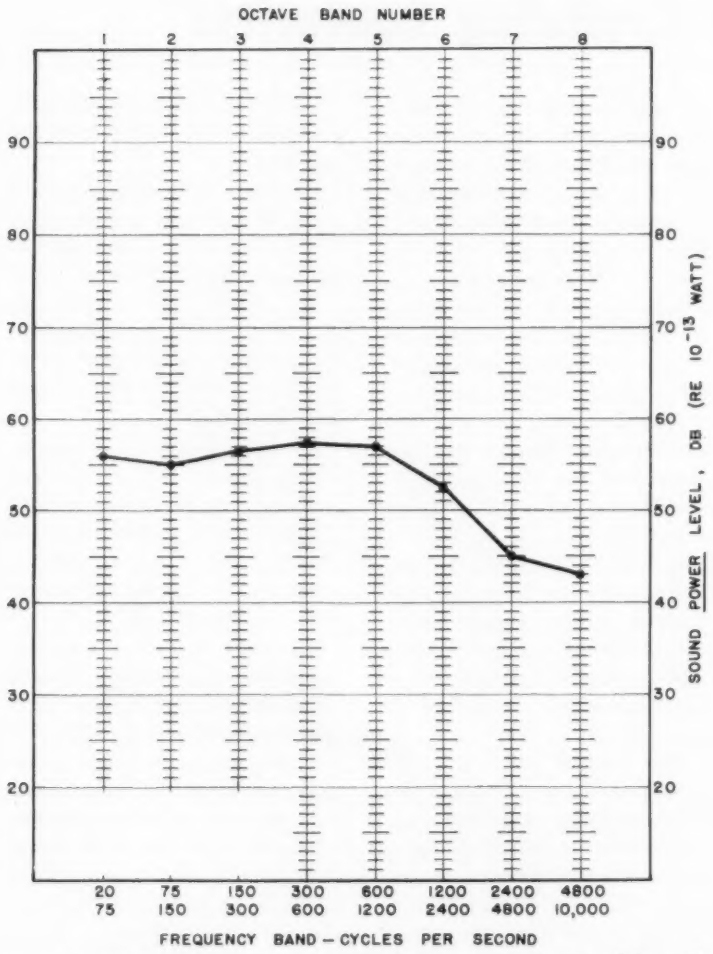
Too much attention is not likely to be given by the contractor to perfecting the adjustment of the flow control valves that must be installed on each heat transmitter. ≠

A suggested PWL-NC Index permits the use of a single number to express sound power level as a function of noise criteria.

Proposed:

A Simplified, Comparable Method For Rating The Sound Output of Air Distribution Equipment

By J. W. SPRADLING
Senior Product Engineer
Carnes Corp.



1 OCTAVE BAND spectrum of sound power level can be plotted by arithmetical addition of sound pressure level and room attenuation

CONSULTING engineers are becoming increasingly aware of inadequacies in the common practice of rating and specifying sound output of air distribution equipment merely in terms of sound *pressure* level.

Although the use of overall sound pressure level (either unweighted scale or weighted A-scale) was formerly recommended in the Heating Ventilating Air Conditioning Guide, the 1957 edition proposed another method, because further study had shown the former method to have objectionable limitations.

One limitation is that sound pressure level readings depend upon the acoustical characteristics of the test location as well as upon the sound output of the equipment.

These characteristics include the distance from the noise source to the microphone, plus room shape, size, and acoustical treatment.

Ratings May Vary

Because of the variation in acoustical characteristics, ratings

What the Terms Mean

Sound pressure level (*SPL*), in decibels, is a measure of the sound pressure acting upon the ear. Reference pressure is 0.0002 microbar.

Sound power level (*PWL*), in decibels, is a measure of the sound power radiated by the source. Reference power is 10^{-13} watt.

Room attenuation (*RA*), in decibels, is the numerical difference between PWL and SPL. It is the reduction in decibels, from the point where the sound is emitted in the room to where the ear or microphone is placed. Factors which determine its magnitude are room size, shape, absorption, and diffusion, and the distance between the source and the listener.

Noise criteria (*NC*) numbers, in decibels, define sound pressure level spectra which have been judged to provide acceptable limitations for background noise for various types of activities, normally performed in rooms and enclosures.

Decibel (*db*), is a mathematical tool used to logarithmically express the ratio of two numerical values. It permits using relatively small numbers to handle very large ratios. Specifically:

$$PWL = (10 \log_{10})\ (W/10^{-13})\ db$$

where

W = sound power, watts

$$SPL = (20 \log_{10})\ (P/0.0002)\ db$$

where

P = sound pressure, microbars

varying by as much as 15 db can be assigned to the same device when tested in different facilities. Further, it was realized that a device which might be considered satisfactory in one location might cause annoyance in another because of differences in the acoustical environment.

It therefore became apparent that there was a need for a rating basis which would be independent of the acoustical environments of test and actual use.

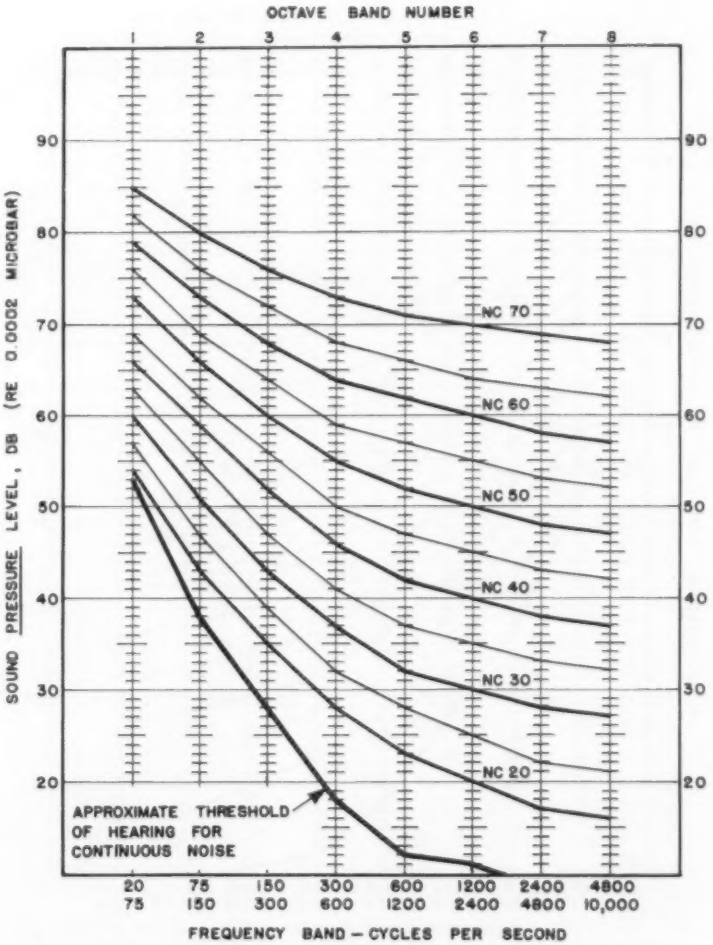
PWL Meets Need

Such a basis is sound *power* level (PWL), for it is a measure of the performance of the equipment itself, rather than of the results in a specific environment.

Using sound power level as the parameter for rating purposes allows the resultant sound pressure level (SPL) to be predicted for various environments of use, regardless of where the sound power level was determined.

Frequency Changes Effect

Another limitation of the overall sound pressure level rating is due to the fact that the ear does not respond uniformly to all fre-



2 NOISE CRITERIA curves establish acceptable background sound pressure level in each of eight octave bands

quencies which comprise a noise.

The ear hears high frequencies more easily, and judges them to be louder. The result of this phenomenon is that two different devices which produce very different spectra may cause the same A-scale reading, yet one sound may be distracting while the other causes no trouble.

The development of the octave band analyzer provided a means of dividing the audio-frequency spectrum into eight bands, in each of which the sound pressure level can be measured. Each band is an octave wide — an octave having a range of frequencies of two to one.

ASHRAE Proposed Method

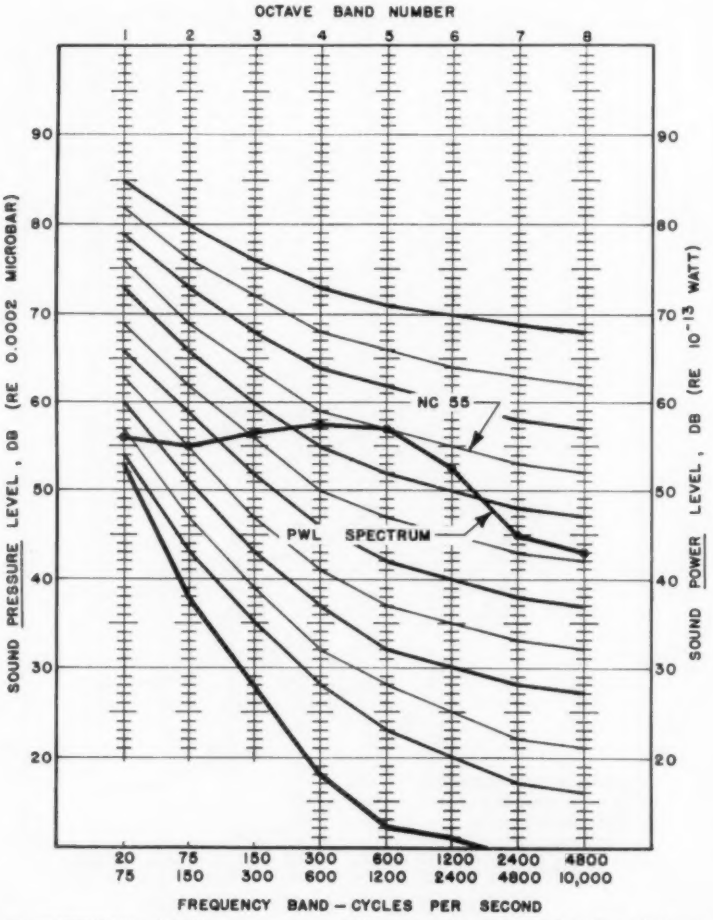
The American Society of Heating, Refrigerating and Air-Conditioning Engineers, through its Standards Project Committee 36, has proposed a standard method for testing devices as to their sound output. This method consists of

a) Measuring the sound pressure level in each octave band, in a reverberant test room,

b) Measuring the room attenuation in each octave band, and

c) Calculating the sound power level in each octave band by arithmetically adding sound pressure level and room attenuation.

An octave band spectrum of sound power level can be plotted from the results obtained in *c* (Fig. 1). This is the information which the engineer needs for close acoustical design. With such information on all devices which will contribute to the background level, he can predict their resultant effect.



3 OVERLAY of PWL spectrum on NC curves shows NC 55 to be minimum unexceeded curve

Fig. 2 (and Table 1 from Chapter 25 of the 1960 HVAC Guide) show the now familiar family of noise criteria curves and the recommended criteria for various rooms. These curves establish acceptable background sound pressure levels in the eight octave bands. It is intended that the specified level should not be exceeded in any band.

Use NC Curves to Rate

In some instances, the noise criteria curves are being employed as a means for manufacturers' ratings of products, rather than for their proper use as a code for specifying permissible background conditions in the rooms of the building being designed.

It should be borne in mind that the noise criteria (NC) number describes a sound pressure level spectrum, and as such is not a satisfactory basis for sound rating equipment.

Using sound pressure level (either NC or A-scale) for sound rating equipment is analogous to the use of room temperature for rating the cooling capacity of equipment. Neither one deals with the performance of the equipment itself, but only with the results in the specific environment.

Again, the proper basis of sound rating is the use of the sound power level of the equipment, just as the proper basis for rating heating or cooling equipment is in terms of the heating or cooling capacity, *i.e.* power.

Need Simpler Method

In many jobs, the economics of the situation do not permit the air conditioning design engineer to spend the time necessary to analyze the proposed system to the extent that the exact number of decibels which must be eliminated in each

octave band to meet the specified noise criteria curve can be predicted.

For such cases, the simplified method is necessary. Such a method utilizes the PWL-NC Index, which permits the use of a single number to indicate the sound power level as a function of noise criteria.

Define Index Number

By definition, the PWL-NC Index is a number assigned to the PWL spectrum of a sound source (when operating at specified conditions) which indicates the minimum NC curve (when room attenuation equals zero) that will not be exceeded in any band.

For example, Fig. 3 shows a sound power level spectrum, resulting from operation of a certain device under a specified condition, superimposed on the noise criteria curves of Fig. 2.

In this case, the minimum curve which the spectrum does not exceed in any band is NC 55. Therefore, this device, for operation at this condition, would have a cataloged sound output rating (PWL-NC Index) of 55 db.

The noise criteria which will result in the room of use can be predicted by subtracting the room attenuation from the PWL-NC Index rating. In the 1960 HVAC Guide Chapter 25, Figs. 18 and 19 (pp 359 and 360) might be used to predict that the room attenuation, also known as "relative sound pressure level" for a given environment of use is 18 db.

Subtracting this from the manufacturer's rating of 55 db, we predict that the minimum noise criteria curve which will not be exceeded in any band due to the sound output of this device is 37 db.

The introduction of this simplified rating method based on sound power level is not intended to discourage the use of a rigorous step-by-step octave band examination of the system. Rather, it is intended to encourage the engineer who has been specifying equipment sound ratings based upon sound pressure levels to convert to a much more meaningful, yet simplified, method.

Adoption of the PWL-NC Index concept, or other sound power level based method, by manufacturers of air distribution equipment would be of great value to the industry, for it would result in comparable ratings.

Thus, it would be possible for the engineer to select equipment by comparison of the published ratings. ≠

Fig. 2 reprinted by permission of the American Society of Heating, Refrigerating and Air-Conditioning Engineers. Original appears as Fig. 3, p. 350, 1960 HVAC Guide.

Public Health Service Calls for Threefold Increase in Air Pollution Research

AN ADVISORY COMMITTEE to the Surgeon General of the Public Health Service recently called for a threefold increase in the Nation's research effort to control the growing menace of extreme air pollution.

The committee recommended that financial support of air pollution research be increased from a current estimated level of $11 million annually to about $32 million a year by 1968. The 10 man committee further recommended that the Federal Government assume 40 percent of this cost, industry 28 percent, and state and local governments together the remaining 32 percent.

In a 40 page report, "National Goals in Air Pollution Research," the committee recommended these 10 national goals for the 1960-1970 decade:

1. Determine the effect of air pollution on human health.
2. Determine the effects on the Nation's agricultural economy resulting from air pollution damage to animals and crops.
3. Find better ways of measuring the economic loss from air pollution damage to materials, and soiling, and reduced visibility.
4. Find better ways of measuring and identifying air pollutants at their source and in community air.
5. Develop better techniques for assessing meteorological factors affecting air pollution.
6. Learn, through research, more about the formation of new pollutants from reactions in the air.
7. Expand our nationwide air pollution monitoring efforts.
8. Develop new methods and equipment for controlling the sources of air pollutants.
9. Build and disseminate a comprehensive body of knowledge related to the technical, legal, economic, and administrative aspects of air pollution.
10. Evaluate the legal and administrative practices related to air pollution control.

Copies of the report, "Public Health Service Publication No. 804," can be secured from the U.S. Printing Office, Washington, D.C. ≠

• **Once the fundamental principles and operations of electronic controls are understood, and their application to various heating and cooling requirements appreciated, the engineer can proceed to "build" the control system he needs by combining electronic, and electric components to suit specific uses. The author describes various applications and the control units which will serve the complex functions arising from the particular needs of any job.**

How to "Build" Electronic Control Systems

By JOHN SCHWARTZ
Automatic Controls Division
Barber-Colman Co.

ELECTRONIC controls, when properly used, offer fast and reliable response action in heating, ventilating, and air conditioning applications. Once the general nature and function of such devices are known, it is an easy step to combining suitable components to produce a variety of specialized results.

Earlier articles dealt with the basic principles of circuitry and function of electronic sensing elements, and with the various types of control available from such devices.

Wheatstone Bridge Is Base

The electronic sensing element operates on the general principle of the Wheatstone bridge. This device measures the difference in voltage across its two parts, or "arms." That voltage difference occurs because of a difference in resistance within the arms. Since in a conductive wire the resistance varies in proportion to the temperature of the wire, this basic circuitry can be used as a temperature sensing element.

As applied to heating and cooling installations, the two arms function as a thermostat, one serving to accommodate a preset resistance (or temperature), and the other acting in response to a variable, such as room temperature. The difference in resistance (and thus voltage) between the two arms is measurable, and can be amplified to serve as a positioning signal to motor operators or actuators.

Employ Block Diagrams

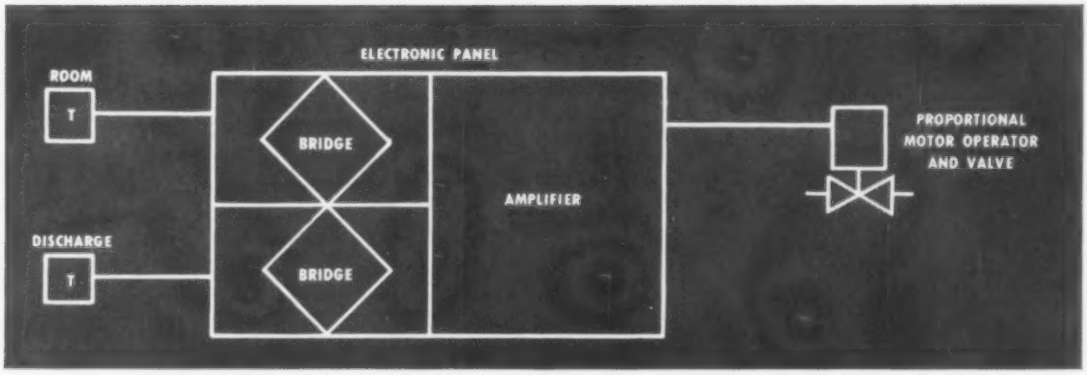
For the purpose of discussion, electronic circuits can be divided into functional sections and so designated by block diagrams.

For example, a room and discharge control application can be drawn as in Fig. 1. A system with room, discharge and outdoor elements separated into its basic bridge and amplifier circuits is illustrated in Fig. 2.

This block diagram covers electronic circuitry that would be used in an application of room and discharge control with summer and winter compensation. From Fig. 2, the concept of systems built up from similar parts is recognizable.

Master Reset Is Possible

In a multizone system to which outdoor reset is applied, the control point of the individual control systems can be reset from a single outdoor element



1 ROOM AND DISCHARGE control application is shown here divided into its functional parts

through a master reset bridge circuit.

This application parallels a pneumatic outdoor master resetting a number of zone submasters. Fig. 3 shows a master reset system, with four control zones indicated. The control point of each zone is reset by the outdoor element in accordance with a predetermined relationship to outdoor temperature.

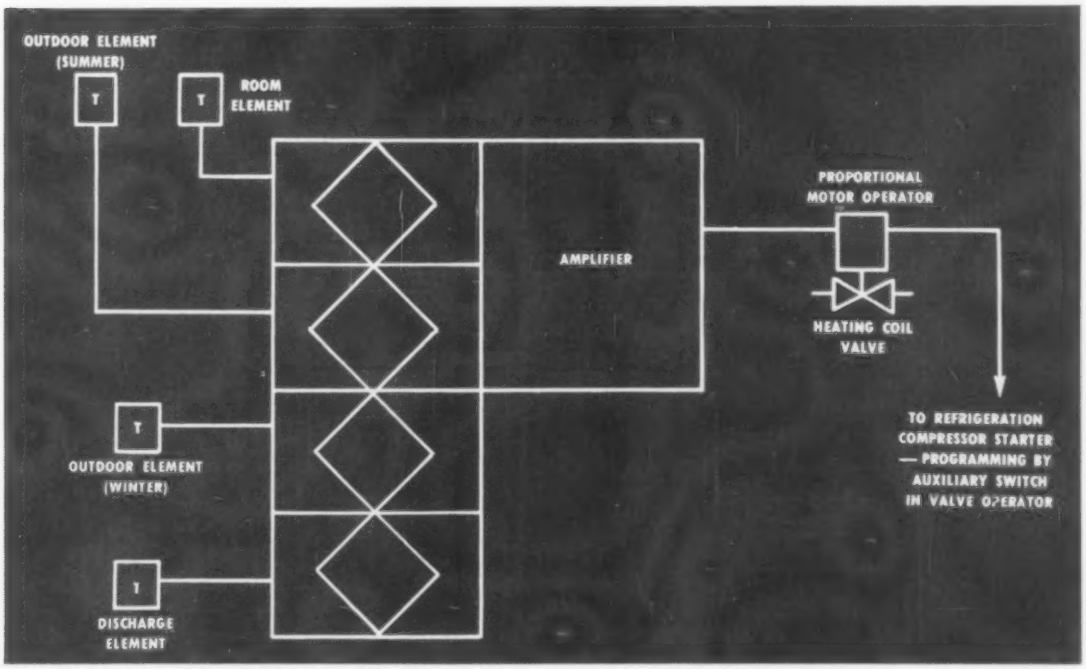
Operation Can Be Sequential

In summer air conditioning applications, using outdoor air plus mechanical cooling, it may be desirable to sequence two or more devices.

For example, a fresh air damper operator may be sequenced with the cooling coil valve operator. When the load requires more cooling than outdoor air alone can provide, the coil valve is gradually opened until the cooling load is balanced. Fig. 4, illustrating the sequencing application, also indicates several sensing elements used to obtain ratio or averaging control.

Again making a pneumatic comparison, sequencing is accomplished in air powered systems by selecting actuator springs with different stiffness factors. When branch pressure changes, the springs compress or extend in sequence. To change the sequence, the springs may be replaced by others of different stiffness.

In electronic sequencing control, the sequence may be changed by providing the bridge circuits with suitable variable resistances which can be adjusted like a radio volume control.



2 ROOM, DISCHARGE, AND OUTDOOR elements included in diagram above illustrate how electronic control systems are built up from similar parts

electronic control systems

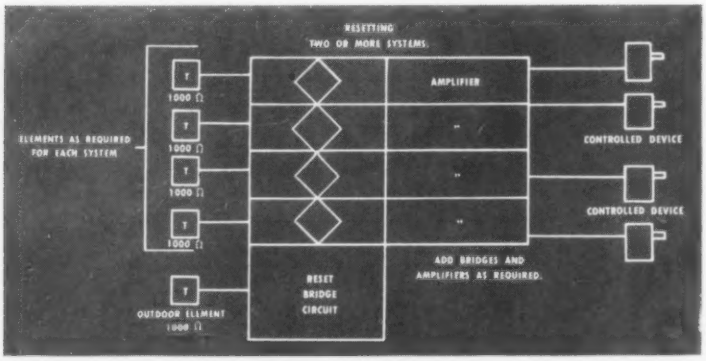
As an electronic accumulator, a multipoint reset circuit allows a single motor operator to be positioned from one of several zones (Fig. 5). The motor operator takes the position required to satisfy the zone which has maximum demand.

Biggest Load Sets Position

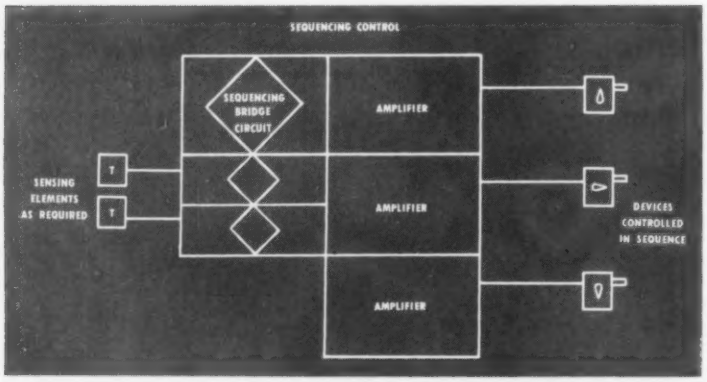
A typical application for this type of control would be a system having a hot and cold deck with multizone distribution controlled by face and bypass dampers. The zone which calls for the most heating or cooling is selected by the multipoint bridge, and the hot or cold deck coil valve is positioned accordingly.

Measure Air Velocity

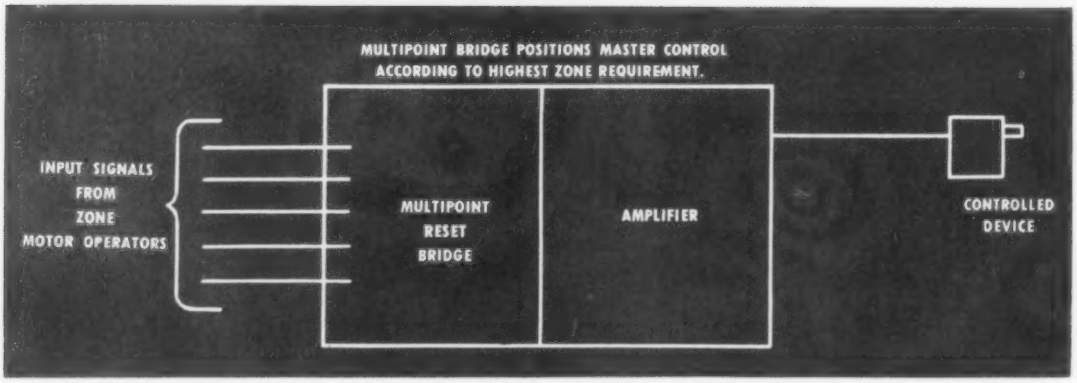
Electronic sensing can be applied to measure the velocity of air flow in a duct system. A duct element is used which dissipates heat to the moving air stream. Changes in air velocity can be detected, since the degree of cooling of the element is a function



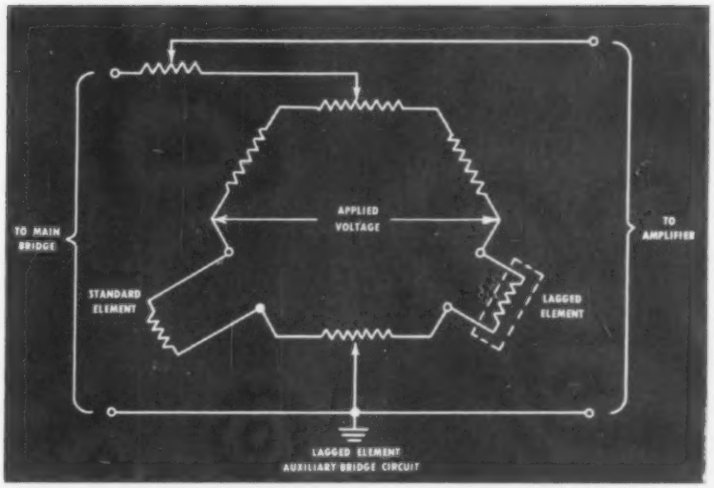
3 MASTER RESET system with four control zones obtains control point reset in each zone by the outdoor element



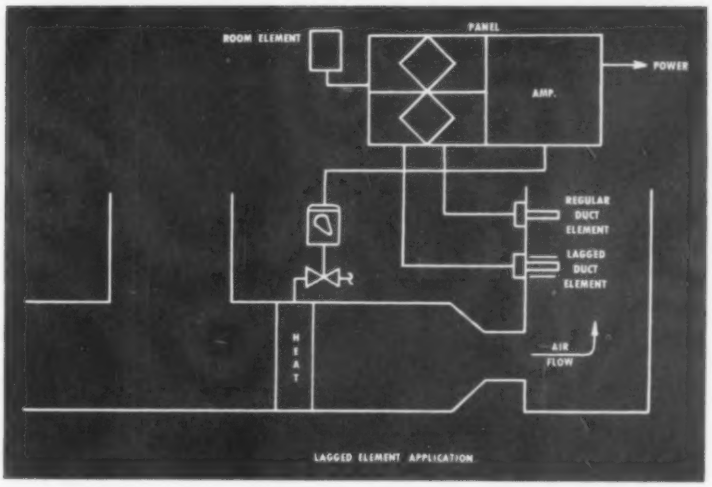
4 SEQUENCING of two or more devices such as dampers and coil valves can be accomplished by electronic controls as illustrated here


MULTIPOINT BRIDGE POSITIONS MASTER CONTROL ACCORDING TO HIGHEST ZONE REQUIREMENT.
INPUT SIGNALS FROM ZONE MOTOR OPERATORS
MULTIPOINT RESET BRIDGE
AMPLIFIER
CONTROLLED DEVICE

5 MULTIPOINT RESET circuit, shown here, allows single motor operator to be positioned from input from any one of several zones. Zone with greatest demand controls system



6 LAGGED ELEMENT is used in company with standard element, responds more slowly than uninsulated coil to oppose its action



7 STANDARD and lagged elements are placed in discharge duct to provide time lag in feedback function, thus stabilizing action

of the velocity of air motion around that element.

Applications for the electronic velocity compensator include static pressure control and reset of hot or cold deck temperatures in accordance with the volume of air movement.

Compensate for Solar Effect

To compensate for solar effect, a temperature sensitive element is enclosed in a weather-tight housing, fitted with a transparent cover. The element is exposed to the sun and connected to a bridge circuit. Here its effect is compared to that of an outdoor element shielded from the sun, thus effecting the solar compensation function. A typical application would be reset of supply water temperature in a sun exposed heating zone.

Insulation Varies Bridge Action

A standard sensing element modified by applying thermal insulation to the resistance coil is called a "lagged element." Because of the insulation, lagged elements respond to temperature change more slowly than do standard units.

The degree of time lag can be controlled by the amount of insulation used to shield the wire coil. A lagged element is normally used in a bridge circuit in company with a standard element. The two are placed in adjacent arms of the bridge (Fig. 6). Both elements are exposed to the same temperature change in a given medium, but the two elements oppose each other in the effect which they have on the bridge output.

Use for Room and Discharge System

Such a device can be used in a room and discharge control system as shown in Fig. 7. The room element would be connected to the main sensing bridge, and the discharge element, consisting of the lagged and standard coils, in the two arms of an auxiliary bridge. Both these elements are located in the discharge air stream.

electronic control systems

The opposing effect of the lagged element occurs only after a time interval required for the lagged element to sense changes in the discharge air temperature.

Since the function of the discharge bridge is to provide feedback, or compensating action, to the room element, thus effecting proportional control, the effect of the auxiliary bridge is to eliminate the control point shift characteristic of all such control systems.

Feedback Is Retarded

It does this by introducing a time lag in the feedback function. This time lag is sufficient for the regular, or unlagged discharge element, to exercise its regular stabilizing influence. Therefore, by the time the lagged element reaches the same temperature as the regular discharge coil, the benefits of discharge control have been established within the system.

The lagged element then compensates for the control point offset produced by the regular discharge element. Thus the full advantage of discharge ratio control is preserved, and in addition, as noted, the control point shift is eliminated.

Humidity Control is Similar

In principle of operation, electronic humidity control is identical to electronic temperature control. The sensing element is a resistance type unit. Resistance of this element varies with changes in humidity. Amplifier and relay arrangements are the same for both humidity control and temperature control units.

Humidity sensing bridges are generally used with single sensing elements because humidity control normally does not require averaging or outdoor reset.

Therefore, the standard humidity sensing circuit is a single element bridge. (Fig. 8) Should the need arise, humidity control systems easily can be arranged to incorporate auxiliary sensing elements such as described earlier.

Use Inorganic Compounds

The electronic humidity control employs an inorganic chemical compound in the sensing element. This provides more stable control than organic elements such as hair or membrane. Sensitivity to variation of ½ percent relative humidity can be realized. Electronic humidity sensing elements are free of drift or change in control point after periods of shutdown.

Control Hot Water Temperature

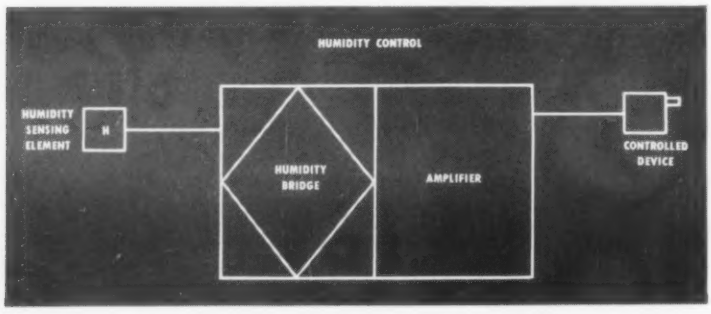
Another practical use of electronic sensing is found in adjustable ratio, outdoor reset, hot water controls. Here the water temperature for heating equipment supply is raised as outdoor temperature drops. A system of this type, illustrated in Fig. 9, is better able to maintain closely regulated temperatures in the building through the use of an outdoor reset controller.

By adding a time switch to change from day to night operation, it is possible to have night depression, morning warm-up, system freeze protection without inside warm-up thermostats.

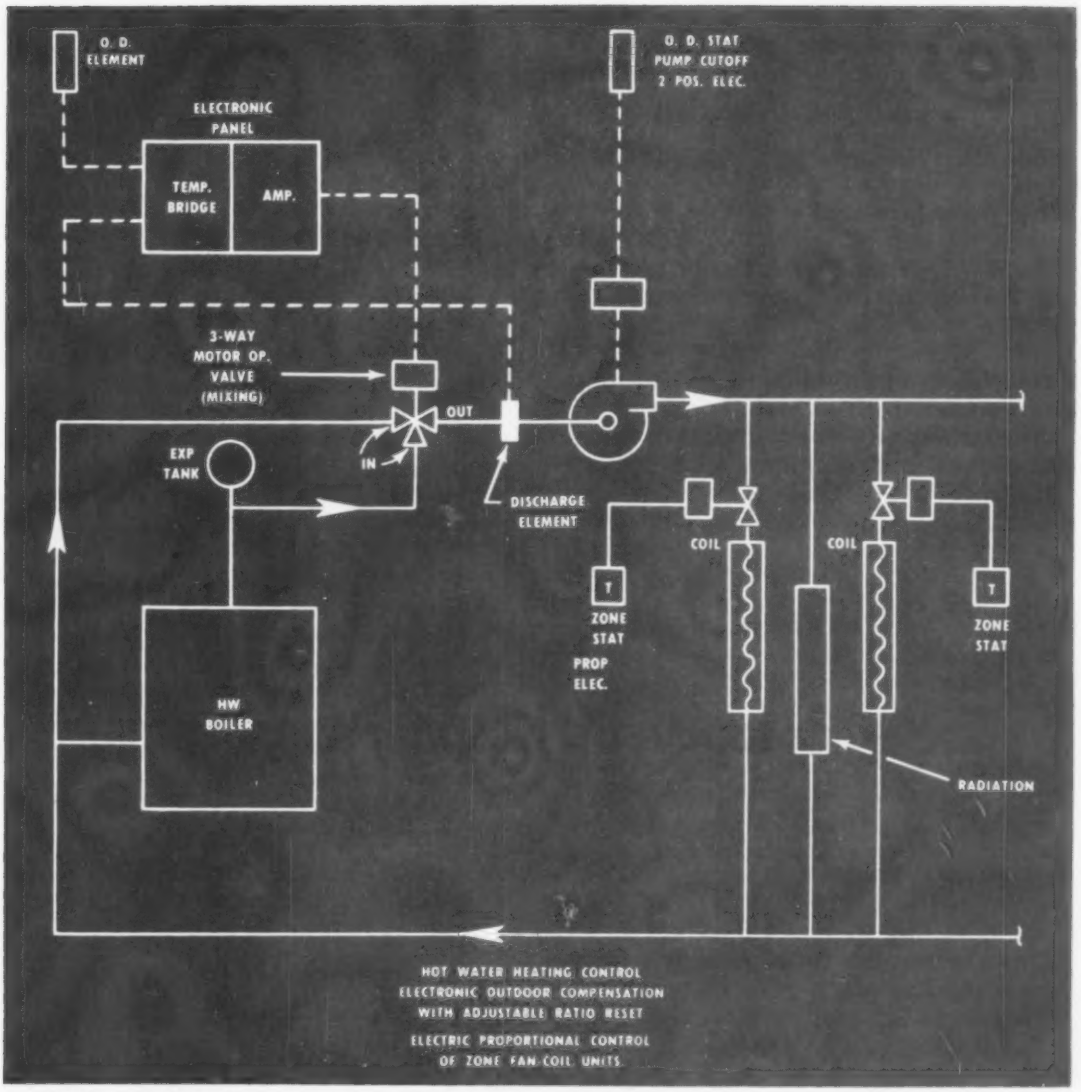
Systems Can Be Combined

The result of the foregoing has been to describe electronic control systems as consisting of two major parts; i.e. the temperature sensing elements, which employ electronic circuits, and the motor operators, which are electric.

However, many occasions arise where the use of standard electric sensing elements will be practical in any electronic system. Fig. 9 illustrates a combina-



8 HUMIDITY CONTROL can be achieved with same basic circuits as are used in temperature control systems



9 WATER TEMPERATURE for supply to heating equipment is raised as outdoor temperature drops, by means of adjustable ratio, outdoor system shown here

tion system; the outdoor thermostat is an electric type, probably with a remote bulb element.

Electronic sensing systems naturally join with electric positioning devices such as valve and damper actuators. In this way, a single energy source powers the entire system. However, air-operated actuators also may be used with electronic sensing elements, providing suitable electro/pneumatic transducers are employed.

It is apparent, then, that there is no reason for a control system to be designed around all electric or all electronic equipment. By specifying controls which are the most suitable for the application, it is possible to benefit from the best features of each type. ‡

The two preceding articles in this series, "Electronic Controls and How They Work," (Dec., 1960) and "How to Use Electronic Controls," (Jan., 1961) explain the basic circuitry in such control systems and the various functions which such systems can be expected to perform.

What sort of man is needed to guarantee the proper operation of complicated equipment in today's modern hospitals?

What must he know?

What must he do?

What is his proper place in the operating scheme of a well organized hospital?

Here, from an engineer who has long been associated with the problem of coordinating engineering and medical techniques, are comments on

The Philosophy of Hospital Engineering

By J. A. MILLARD
Hospital Consulting Engineer

IN ORDER to understand the role of an engineer in a modern hospital, it is necessary to analyze or review the following:

What is a hospital?

What is an engineer?

What is a doctor?

When these are fully appreciated, then one can proceed to an understanding of the relation between engineering and medical treatment, and from this discover what sort of an engineer is needed in the modern medical facility.

A Hospital Is A Business

The modern hospital of today is one of the more complicated organizational structures in American business. It may no longer be possible for one man to administrate the whole organization, even in a small community type hospital.

The hospital in itself no longer sells or gives medical care. Instead, its main purpose is to *provide and maintain facilities* for the use of physicians and nursing staff, in order that they might give adequate care in healing and prolonging human life.

Note the words "provide and maintain facilities," for in them lies the whole justification for the work of the hospital engineer and maintenance man.

Engineering Is Prime Factor

Money for a new hospital or for an addition is normally provided by the public. This capital investment is never fully recovered from paying patients. Hospitals are designed in compliance with regulations established by local, state, and federal health service agencies.

Architects are given credit for this design by the general public, but it should be pointed out that over 80 percent of hospital design is done by engineers of several types. To this extent, the architect acts as coordinator and business agent for a group of engineers.

Over 50 percent of the capital investment in the modern hospital goes to mechanical, electrical, and plumbing facilities. In fact, medical and other equipment can no longer be distinguished from mechanical or electrical equipment as such.

A capital expenditure of $10 thousand to $20 thousand per bed cannot be economically and morally justified unless provision is made to protect the investment by the establishment of an organization with personnel trained in hospital engineering, man-

agement, and administrative functions.

Thus, personnel must be provided and trained to operate, maintain, repair, provide new installations, and integrate changes and improvements that will keep up with the rapid advance of hospital equipment and technique.

"Engineer" Is Not Catch-All Term

There are many types of engineers, but even so, the word is one of the most misused in the language. For more than eight centuries, "engineer" has meant the designer, inventor, creator, of engines and other ingenious contrivances. But for about 100 years, the word has been misapplied, to include *operators* of engines of one sort or another. History is on our side. The word should be used in the professional sense, and not to designate a locomotive driver, etc.

Now days men who operate ship engines call themselves "marine engineers." A century before the steamboat was invented, marine engineer meant a naval architect — a designer and builder of ships. One who operates engines and boilers with several assistants calls himself a "chief engineer." That title was used in Germany to designate the professional in charge of management more than a century before the steam engine was invented.

The driver or repair man for an automobile doesn't call himself an engineer. Likewise the locomotive driver is not an engineer in the true sense of the word.

"Engineer" Has Been Defined

The creed of the National Society of Professional Engineers equates the proper acceptance of engineering responsibility with the aim of the betterment of human welfare, and with a dedication to public service.

The legal definition of an engineer is as follows:

"The practice of professional engineering within the meaning and intent of the law includes any professional services, such as consultation, investigation, evaluation, planning, design, or responsible supervision of construction or operation in connection with any public or private utilities, structures, building, machines, equipment processes, works, or projects, wherein the public welfare or safeguarding of life, health or property is concerned or involved, when such professional services require the application of engineering principles and data."

What are engineering principles? They may be defined in terms of any of the physical sciences. An engineer makes use of these principles to seek practical application of the forces and materials of nature for the use and benefit of mankind.

Mr. Millard is a graduate of the West Virginia University College of Engineering, and is a registered professional engineer in West Virginia and Ohio. He served with the W. Va. Public Service Commission engineering department for 10 years, has been a hospital chief engineer, consulting engineer for the W. Va. Department of Mental Health, and is at present in private practice as a hospital consulting engineer in Lima, Ohio. He is a member of several professional societies.

Such principles are used daily in hospital plant operation, maintenance, repair, food preparation, medical sciences, safety, etc. Thus the very life, health, safety and comfort of people depend to a great extent on the skill of the engineer.

There are several times more types of engineers than doctors. There are in fact between 500 and 800 kinds of engineers, and of these, one is the hospital engineer.

Duties Are Specific But Varied

The characteristics and duties of the hospital engineer are many. In general, he is a man with a broad engineering background, with administrative ability to coordinate his responsibilities with all department heads. Some years ago I listed the characteristics of the hospital engineer. Besides the general principles of reason and resourcefulness characteristic of every good engineer, the list included the following:

1) He understands the language of both the professional and lay personnel required to operate a hospital.

2) He establishes a safe, efficient, and uninterrupted operation of all plant equipment, including surgical and medical equipment, appliances, or apparatus where items require routine inspection and maintenance for safety protection.

3) He must be familiar with every piece of equipment used throughout the hospital; including building materials, roofing, furniture, plumbing equipment and supplies, electrical equipment, sanitation and sewerage, steam generation, refrigeration, elevators, operating rooms, oxygen and suction machines, x-ray, electrocardiograph, metabolism, physiotherapy, kitchen and dining rooms, laundry and many other devices.

Must Aid in Administration

4) He must be capable of advising the administrator on equipment purchases, facility expansion, and policy formulation.

5) He must be willing to work hard with his hands, and to do unpleasant jobs that are characteristic of a hospital.

6) He must be loyal to and trust his administrator. He must be a good follower as well as a leader.

I have asked several doctors for a definition of "doctor." All claimed that such a definition is impossible. I think it may be defined in simple terms. A doctor is the maintenance engineer of the human body.

Medicine Is Also Engineering

It is my firm belief that a physician or surgeon must practice some form of engineering in order to follow his profession. Even the methods used by the psychiatrist in analysis are fundamental to the analytical mind of the professional engineer.

Hospital publications and medical journals now show the coordination that is taking place between doctors and engineers in the development of better treatment methods. Doctors are beginning to realize that many scientific principles they use are basically engineering principles, used by industry long before adoption by the medical profession.

It is very evident that if tomorrow's doctors and nurses are to understand the proper applications and capabilities of their equipment, they will have to be taught more engineering and more mechanical principles. This may be the most important single offering of the hospital engineer.

Abuse Complicates Maintenance

I am thoroughly convinced that the biggest maintenance problem in any hospital is the misuse or abuse of equipment due to a lack of knowledge. It is not a case of negligence, but one of a lack of understanding. Hospital personnel must be taught the proper function and operation of their equipment — how to care for it, how to recognize impending trouble, and what to do when trouble develops. And most important, they must be apprised of the cost involved in neglect. Not financial cost only, because faulty equipment can cost a life.

Prevention Starts With Basics

Little things that can be prevented (like stopped drains on all kinds of equipment) are the things that require too much time from the maintenance man, causing him to neglect more important maintenance without which serious breakdowns can occur. The simple problem of stopped drains once consumed about 12 man hours a day in a hospital of my experience. A well rounded educational program for the staff reduced that cost to one man hour per day, even when equipment in use was increased by 35 percent.

Troubles must be logged until repeaters are found, after which proper education and supervision can cure the problem. Sometimes hospitals employ engineers who are unwilling or unable to conduct this kind of program.

Engineer Should be Administrator

It is my personal belief that the hospital engineer should be placed at a high administrative level, with sufficient authority to control and supervise his many indirect responsibilities with all other departments. The modern hospital needs an administrative engineer with actual hospital engineering experience, who can be directly responsible to the administrator for the following services:

1) The safeguarding of life, health, and property when the applications of engineering data and principles are required.

2) Consultation with the governing board, administrator, department heads, and other engineers during the planning, design, and construction of new facilities.

3) Supervision of all construction, remodeling, maintenance, and repair.

4) Establishment of fire and safety directives, and supervision of the control which is necessary to insure safety.

5) Establishment to preventive maintenance directives and the supervision of these.

6) Engineering and cost analysis and advice.

7) Engineering, mechanical, and safety education for all staff members.

8) Other technical duties and reports that may be required by either private, public, or governmental agency.

To reach any real degree of success in hospital operations, the use of the engineer's analytical approach is a must.

Build on These Principles

Here are four firm and basic policies upon which each hospital engineer should build:

1) To aid the hospital in giving the best possible patient care for the least possible cost.

2) To dedicate himself to hospital service, by finding a creed and living up to it.

3) To keep abreast of the engineering aspect of medical and hospital equipment and new developments.

4) To keep his administrator thoroughly and accurately advised of activity and needs within his purview.

It can be truly said that hospitals which have recognized engineering as a component of management are operating in an organized and efficient manner. The hospital engineer is the one person in the medical family who can do most towards reducing the cost of patient care. ≠

AN HPAC REPORT ON RESEARCH

How Finned Streamlined Heat Exchanger Tubes Perform

By David M. Adams

Finned streamlined heat exchanger tubes for liquid-to-air or vapor-to-air heat transfer offer potential savings in material and air pumping requirements when compared to conventional finned circular tubes in use today according to the research reported herein. Increased heat transfer effectiveness arising from greater utilization of the surface of the streamlined fin will permit reduction of the size of a single bank heat exchanger by as much as 35 to 50 percent over the range of air velocities studied (400 fpm to 2800 fpm).

Pressure losses range from 1/4 to 1/2 those for finned circular tubes with corresponding reduction of air pumping requirements of 4 to 16 percent for a given air velocity. Further reduction in air pumping requirements (for particular applications) result from the lower air quantity required for a given heat transfer.

The data reported apply only to heating or dry cooling processes and additional study is needed to completely evaluate the utility of the finned streamlined tubes. While not commercially available at present, this research may well indicate the shape of heat transfer surface in the future.

This report is based upon Mr. Adams' thesis submitted recently in partial fulfillment of the requirements for the degree of Master of Science in mechanical engineering at Texas A & M. He is continuing study for a PhD in mechanical engineering at Oklahoma State University with special emphasis on heat and power. The author's experience ranges from work in the various crafts associated with installation and operation of heating, piping, and air conditioning systems to instructor in the hydraulics laboratory of the Illinois Institute of Technology.

Finned Streamlined Heat Exchanger Tubes

A HEAT EXCHANGER may be defined as a device constructed in a particular manner for the explicit purpose of transferring energy from one substance to another. The performance of heat exchangers in the field of heat transmission is of vast importance from the standpoints of economical production and operation, unit compactness, and inexpensive maintenance. Much work has been done on cross-flow finned tube heat exchangers to obtain these desirable characteristics. The heart of this type of heat exchanger is the heat exchanger tube and in order to make the bare tube more effective in transferring heat, fins are attached to it. An important criterion which makes one finned tube function better than another is their relative geometrical shapes.

To date, one of the most commonly employed finned tube shapes is that with a circular cross-section. The finned circular heat exchanger tube has been studied extensively, both experimentally and mathematically. It was found that it has an economical production but that it has low heat transfer rates and high pressure losses. In consequence, its unit size is bulky and its opera-

1 STREAMLINED and circular finned tube cross sections used in this research are shown here approximately ¾ actual size. The fin area and wetted tube perimeter are the same for both tubes. Copper fins were individually soldered to the copper tubes. The circular tube O.D. was 1⅝ inches and this dimension was used as the hydraulic diameter to evaluate Reynolds number for both tube shapes as their wetted perimeters were equal. A single tube of each shape was tested in this research

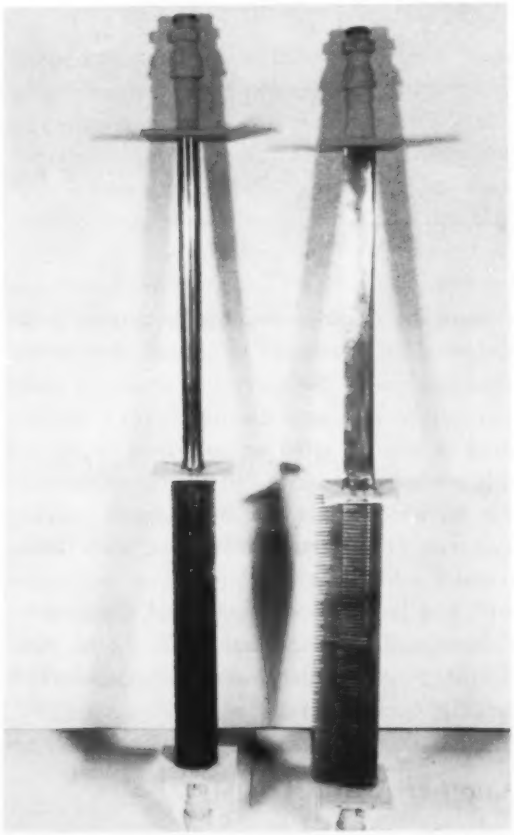
tional costs are high. According to recent data* by the author, the finned streamlined tube may make an excellent heat exchanger tube in that its high heat transfer rates are accompanied by both low pressure losses and economical operation. A comparative study of these two types of finned tubes will reveal these differences in overall performance.

*Since the mathematics of this problem is rather complex and of questionable validity owing to variable heat transfer conductances about the surfaces of the finned tubes, the analysis was of experimental nature.

What the Tests Show

To obtain a consistent set of data for an accurate comparison of the two shapes of finned tubes, it was necessary to study the bare tubes as well. Fig. 1 shows the shapes of fins used and Fig. 2 shows the complete bare and finned tubes. For each of the bare tubes the outside perimeter, the wall thickness, and the length were equal. Fins of equal surface area, spacing, and thickness were soldered (to insure a good thermal seal) on identical respective tubes. All fins and tubes were made of copper. In this way, any differences incurred in performance characteristics were primarily related to the relative geometrical shapes of the finned tubes.

Water near the boiling point was passed through the tubes and ambient air was forced cross-flow over the tubes. All temperatures were measured with thermocouples and all pressures were measured using inclined water manometers. The heat transfer rates were based on the water side measurements since this method was most accurate.



2 FINNED and bare test sections of each tube were combined to provide the section under test with a water straightener section. Each test section was 23¼ in. long and the total length of each tube type was 4 ft

Measured Heat Transfer Rates

Primarily, the heat transfer rates from and the pressure losses over the tubes were evaluated. When plotted on log paper versus the air flow [Reynolds number (N_{Re})], these values approximated straight lines. The derived equations for the heat transfer (Q) per degree mean temperature difference (ΔT_m) between the air and water (overall conductance) were thus found to be as follows:

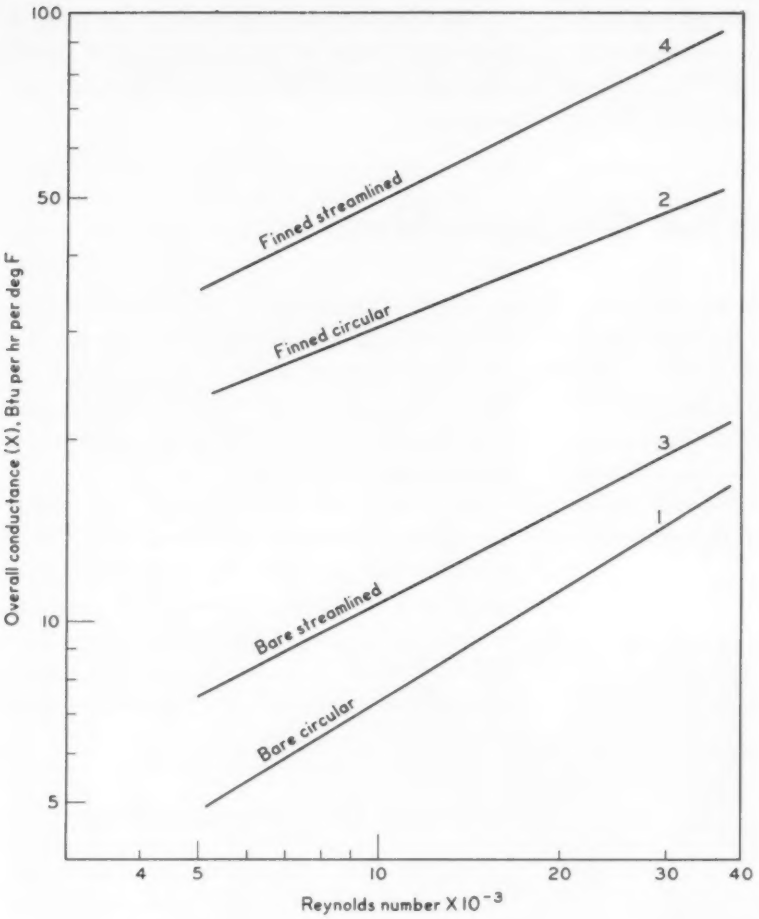
1) $X_{bc} = 0.0283\ (N_{Re})^{0.608}$ Btu per hr per deg F

2) $X_{fc} = 0.9760\ (N_{Re})^{0.376}$ Btu per hr per deg F

3) $X_{bs} = 0.1000\ (N_{Re})^{0.510}$ Btu per hr per deg F

Properties of bare and finned tubes studied in this experiment are listed here. Geometry of streamlined and circular tubes was identical so data tabulated apply to both

Tube			Fin		
Perimeter, in.	Length, in.	Wall thickness, in.	Thickness, in.	Surface area, sq. in.	Fins per in.
5.1	23.25	0.062	0.0162	13.50	3.18



3 OVERALL CONDUCTANCE of bare and finned test sections is plotted here as a function of Reynolds number. The conductance was computed from measured heat transfer on the water side of the tubes and mean temperature difference between air and water

4) $X_{fs} = 0.5530\ (N_{Re})^{0.491}$ Btu per hr per deg F

In these equations, $X = Q/\Delta T_m$ and the subscript *bc* refers to bare circular, *fc* to finned circular, *bs* to bare streamlined, and *fs* to finned streamlined tube. A graphical representation of these equations is shown in Fig. 3

Fin Effectiveness Defined

Combining the proper equations results in two dimensionless ratios which are defined here as the fin effectiveness. They are:

5) $X_{fc}/X_{bc} = 34.55\ (N_{Re})^{-0.232}$

6) $X_{fs}/X_{bs} = 5.52\ (N_{Re})^{-0.0188}$

These equations are shown in Fig 4. It is important to note that the effectiveness of the streamlined fin is almost constant whereas it decreases markedly for the circular fin as the air flow is increased.

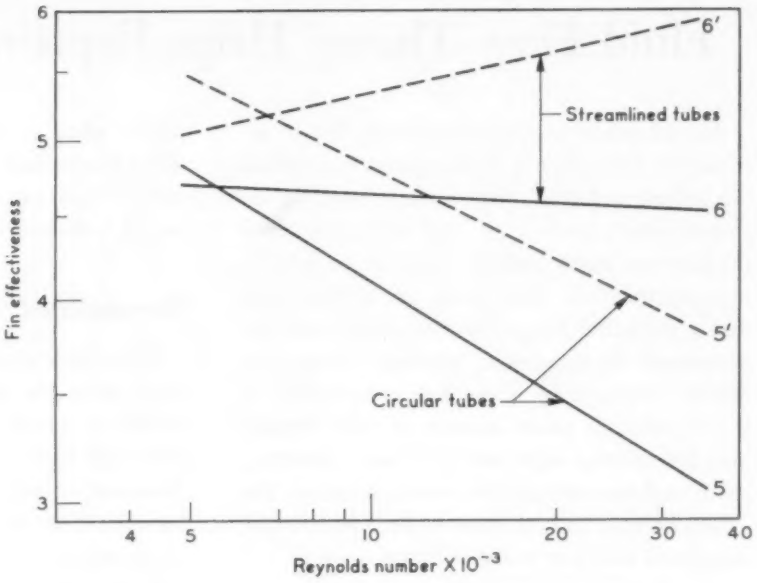
Since the air side resistance (resistance is the reciprocal of conductance) equals the overall resistance minus the water side resistance (neglecting the resistance of the copper), calculations of the fin effectiveness based on the air side conductance shows that for the streamlined fin, fin effectiveness actually increases with air flow rate (Fig. 4, curve 6'). Thus, when the internal conductance is very high, as is the case with a boiling or condensing liquid, the fin effectiveness will increase. Notice that the fin effectiveness of the circular fin still decreases markedly (Fig. 4, curve 5').

Compare Heat Transfer Rates

Now, consider the ratio of the conductances for finned streamlined and circular tubes:

$$X_{fs}/X_{fc} = 0.560\ (N_{Re})^{0.1154}$$

For the range of air flows investigated, the



4 FIN EFFECTIVENESS for streamlined and circular tubes is plotted here. Fin effectiveness was computed as the ratio of conductance for a finned tube to that for a bare tube of the same geometry. Solid lines (5 and 6) are fin effectiveness based upon overall conductance; dashed lines (5′ and 6′) are fin effectiveness based upon air side conductance

finned streamlined tube transferred from 51 to 89 percent more heat per degree mean temperature difference than the finned circular tube. This is a significant increase. This comparison is based on the overall conductances to show clearly the relative effectiveness of the two surfaces in transferring heat for equal mean temperature differences. The results given hereafter would not be changed significantly if the comparison was based on the rate of heat transfer alone.

Measured Pressure Losses

The pressure losses over the tubes can be represented by the following equations:

7) $\Delta P_{bc} = 0.04\ (N_{Re})^{2.05}$ (lb_f per in^2) $\times\ 10^{-10}$

8) $\Delta P_{fc} = 2.46\ (N_{Re})^{1.68}$ (lb_f per in^2) $\times\ 10^{-10}$

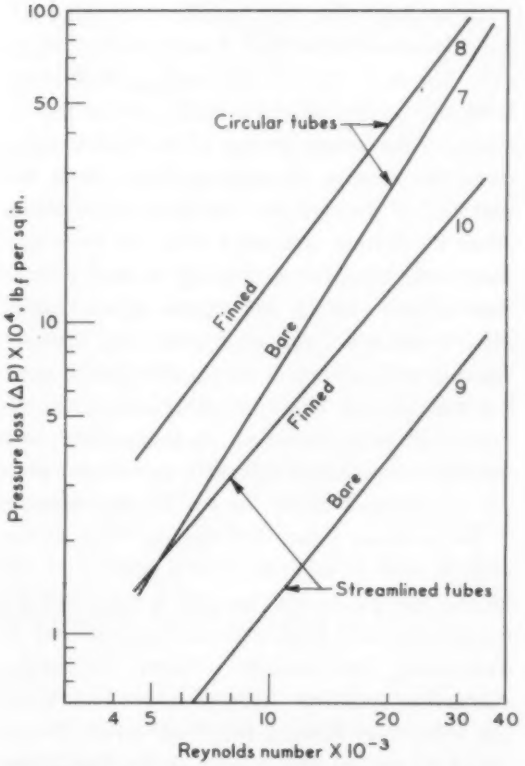
9) $\Delta P_{bs} = 0.35\ (N_{Re})^{1.63}$ (lb_f per in^2) $\times\ 10^{-10}$

10) $\Delta P_{fs} = 4.80\ (N_{Re})^{1.49}$ (lb_f per in^2) $\times\ 10^{-10}$

These equations are plotted in Fig. 5. From the dimensionless ratio

$$\Delta P_{fc}/\Delta P_{fs} = 0.512\ (N_{Re})^{0.192}$$

it can be shown that the pressure losses over the finned circular tube vary from 2.6 to 3.8 times those over the finned streamlined tube in the range of air velocities used. Again, this is a significant increase.



5 PRESSURE LOSSES of streamlined tubes were less than those of circular tubes as shown in these curves relating pressure loss and air velocity (Reynolds number). The finned circular tube had pressure losses varying from 2.6 and 3.8 times those of finned streamlined tube over the range of air velocities used

Fluid Flow Theory Helps Explain Performance

An old axiom in engineering says that to increase the heat transfer from a particular surface the turbulence about that surface must be increased which, as a result, will tend to increase the pressure losses. Indeed, it is a compromise to regulate the fluid flow about the surface such that a particular rate of heat transfer is not accompanied by intolerable pressure losses. The finned circular tube obeys this compromise in that it achieves practical rates of heat transfer only by suffering high pressure losses. However, the finned streamlined tube seems to violate this axiom because its high rates of heat transfer are associated with low pressure losses.

Separation Affects Circular Tubes

To explain this, first consider a circular cylinder immersed in a fluid flowing normal to its axis. The fluid (air in this case) will separate from the surface of the cylinder due to the inability of the kinetic energy of the fluid to overcome the adverse pressure gradient about the rear half of the cylinder. The fluid will separate about 80 degrees, measured from the front surface of the tube, for air flowing in the turbulent zone ($N_{Re} > 1000$) and up to approximately $N_{Re} = 100{,}000$ (separation point was constant for this study since this range of Reynolds number was $5000 \leq N_{Re} \leq 35{,}000$). At this point, there will be a minimum in the surface heat transfer conductance that will reduce the average conductance about the surface significantly.

The pressure losses over the rear half of the cylinder will be high because a portion of the kinetic energy of the separated fluid will be transformed into fluid internal energy instead of overcoming the pressure gradient. Thermodynamically speaking, the pressure loss times the volume of flowing fluid will equal the increase of the internal energy of the fluid (neglecting the minute change in the fluid kinetic energy and volume due to its expansion to a lower pressure). This is sufficiently accurate for small pressure changes. These pressure losses create what is commonly called drag forces about the surface (drag forces are produced by skin friction too, but are negligible when speaking of turbulent flow).

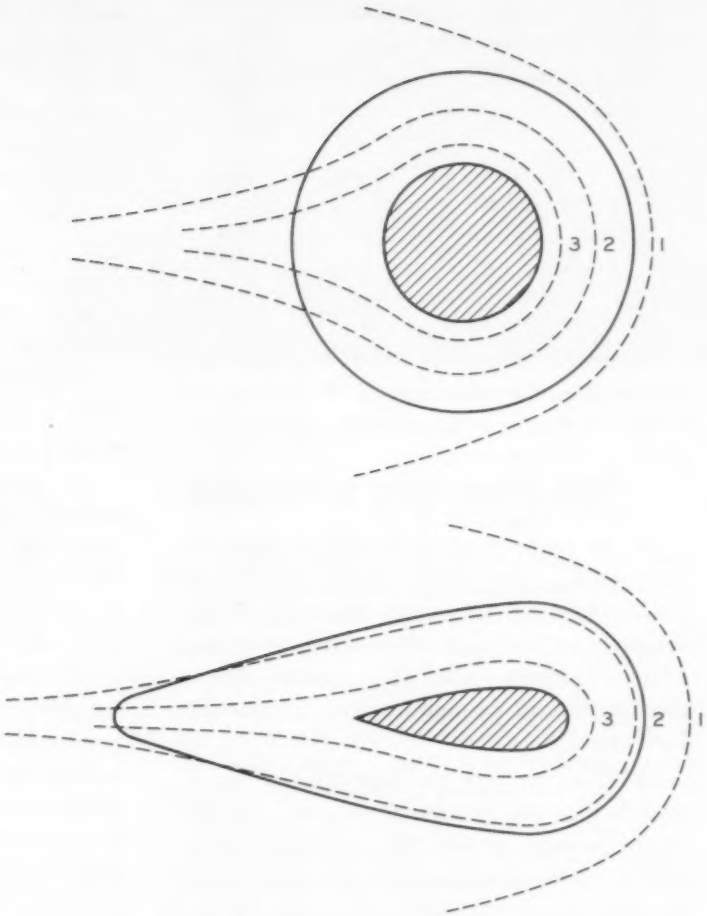
Streamlined Tubes, No Separation

For a streamlined body, the fluid will not separate from the surface because of its gradual curvature which allows the kinetic energy to overcome easily the gradual pressure gradient. However, at very high velocities, the fluid may separate from the rear of the tube. Since there is no separation point, the average conductance will be high and the pressure losses low. The pressure losses are produced primarily by skin friction. This reasoning can be used to explain why the bare streamlined tube more effectively transferred heat and suffered lower pressure losses than the bare circular tube. These results have been borne out by other investigators.

Relate Flow and Heat Transfer

Now, consider any body placed in a stream of fluid. At small fluid velocities (viscous forces large compared with inertia forces) there is vorticity, or circulation, in the whole region of flow around the body. For large velocities (viscous forces small compared with inertia forces), there is a field of flow in which the vorticity is confined to a small layer along the surface of the body and in a wake behind the body, whereas the rest of the flow remains, practically speaking, free from vorticity. As a result, for very small velocities the fluid around a heated body is affected uniformly on all sides.

However, with increasing velocities the region affected by the higher temperature body shrinks progressively into a narrow zone in the immediate vicinity of the body and into a tail of heated fluid behind it. From the above reasoning, it is seen that the circular fin becomes less effective with increasing fluid flow because the amount of fin surface area located in the vorticity or in-



6 SIMILARITY between temperature and vorticity (or circulation) distribution in the neighborhood of a heated body in a stream of fluid is shown here. The dashed lines 1, 2, and 3 indicate regions of increased local velocity and turbulence for low, moderate, and high flow velocities, respectively. These also indicate regions of high temperature. The fins are superimposed upon the vorticity distribution. Note that the streamlined fin has a greater portion of its surface area in the zones of high velocity and turbulence

creased temperature zones decreases markedly (Fig. 6).

For the streamlined fin (Fig. 6), the decreasing region of increased temperature is advantageous since the fin was designed so that most of its surface area (for moderate air velocities) was located in these zones of vorticity and high temperature (essentially high velocity and turbulent zones). Since the vorticity and fluid stream disturbance is less for the streamlined body than for the circular body, the zones indicated in Fig. 6 will be larger for streamlined tubes than for circular tubes for equal fluid flow. Thus, the utilization of these zones by the streamlined fin is indigenous to its high fin effectiveness.

Comparison of Practical Design Considerations

Now compare the performance of the two finned tubes practically, considering unit size, economics of operation and production, and maintenance.

- *Unit-Size*

a) The physical size of a finned tube heat exchanger, where heat transfer is the design factor, will primarily depend upon the number or length of tubes necessary to transfer the required amount of energy. For the single tubes discussed here, it is assumed that the heat transfer from them is proportional to their lengths. This is approximately valid remembering that the temperature drops across each respective

length were small in comparison to the overall temperature differences between the heat exchanging mediums. The amount of heat transferred from Y-length of finned streamlined tube is:

(m) $X_{fs} = Y/L_{fs}\ 0.553\ (N_{Re})^{0.491}$ Btu per hr per deg F

The heat transferred from L_{fc}-length of finned circular tube is:

(n) $X_{fc} = L_{fc}/L_{fc}\ [0.976\ (N_{Re})^{0.376}]$ Btu per hr per deg F

The length of finned streamlined tube that will transfer the same amount of heat as the finned circular tube is found by equating (m) and (n) where $L_{fc} = L_{fs}$:

$Y = [0.976\ (N_{Re})^{0.376}/0.553\ (N_{Re})^{0.491}] \times L_{fc}$

$Y = 1.77\ (N_{Re})^{-0.115} \times L_{fc}$

For the range of air flows used, Y decreased from $0.66L_{fc}$ when the minimum duct velocity was 400 fpm to $0.53L_{fc}$ when the maximum duct velocity was 2800 fpm. This would result in a 34 to 47 percent reduction in material (recall that the material per unit length is the same for both cases).

b) When air flow and heat transfer are design factors, the amount of material reduction would be even greater. This is because of the higher velocities which would occur with equal air flow but the smaller surface area required for streamlined tubes.

Incidentally, the finned circular tube studied in this research had fins mounted perpendicular to the axis of the tube, whereas in practice, spiralled finned circular tubes are commonly used. The results were checked between the two at moderate air velocities and it was found that the latter type of finned tube had slightly better heat transfer characteristics, but higher pressure losses, than the former finned tube. These differences are largely due to the effect of the pitch angle and wavy surface of the spiralled fin on the amount of turbulence created between each fin. Thus, the above results would not be changed significantly.

- *Economics of Operation*

As a result of the above mentioned reduction in material needed (para. a), the air flow can be similarily decreased. This would mean a substantial savings in air pumping requirements. The pumping requirements can be further reduced by virtue of the low pressure losses over the finned streamlined tube. For example, a reduction of from 4 to 16 percent in pumping requirements was observed for the finned streamlined tube relative to the finned circular tube for equal tube lengths and air flows.

- *Economics of Production*

It is realized that the productions costs for the finned streamlined tube will be greater than those for the finned circular tube. However, the substantial savings in material discussed above could possibly more than offset these increased costs.

- *Maintenance*

The internal maintenance of the finned streamlined tube should be comparable to that of the finned circular tube if it is used in a system involving non-corrosive and non-scale producing mediums (for example, refrigeration systems employing halocarbon refrigerants). If water or some other corrosive and scale producing substance is used, the maintenance may be a problem due to the cross-sectional shape of the streamlined tube which could make internal cleaning more difficult than for the circular tube. The external maintenance should be about the same for both cases.

Where They Could Be Used

The chief applications of the finned streamlined heat exchanger tube would be in the refrigeration, heating, and air conditioning fields. Its use in large industrial units would be advantageous from the standpoints of unit compactness and economical operation. The results presented here were for its use as a single tube condenser (internal medium could just as well have been a condensing liquid), but could apply equally as well for its use as a single bank evaporator or condenser. Further work is necessary for the study of its use in multiple bank evaporators and condensers.

Extended research on the subjects discused above and on the development of an optimum streamlined fin-and-tube shape will be required to completely evaluate the utility of the finned streamlined tube over that of the finned circular tube.

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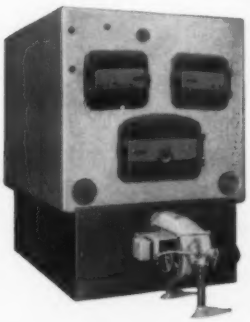

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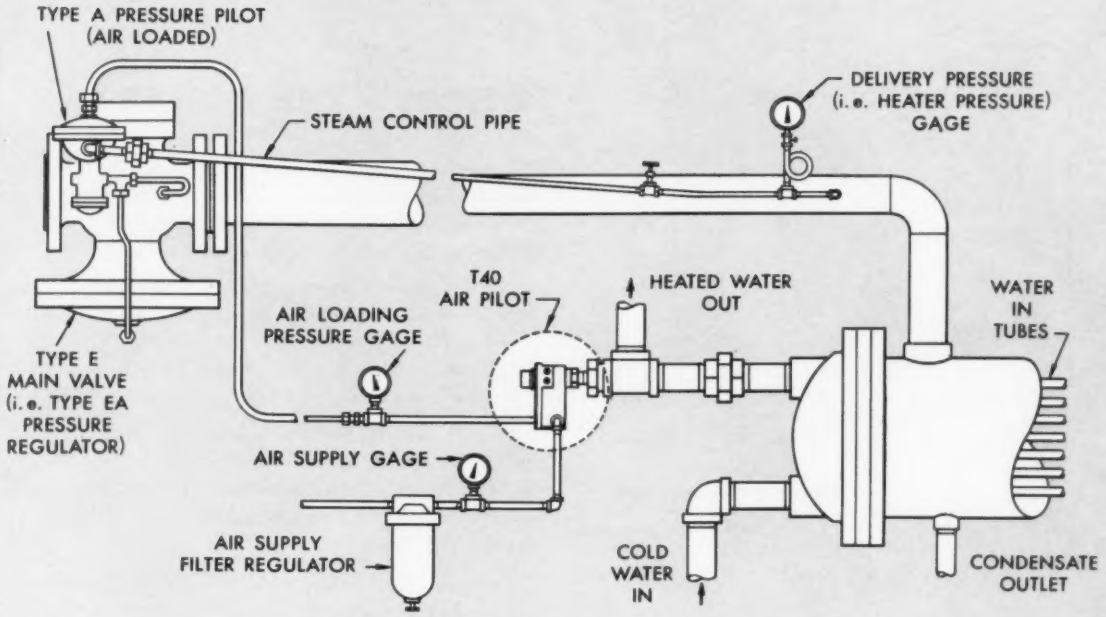
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STEAM CONTROL PIPE
DELIVERY PRESSURE (i.e. HEATER PRESSURE) GAGE
T40 AIR PILOT
HEATED WATER OUT
WATER IN TUBES
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- Field reversible for heating or cooling

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For complete information on these new air controlled temperature and pressure control systems, write for your copy of Bulletin 9.

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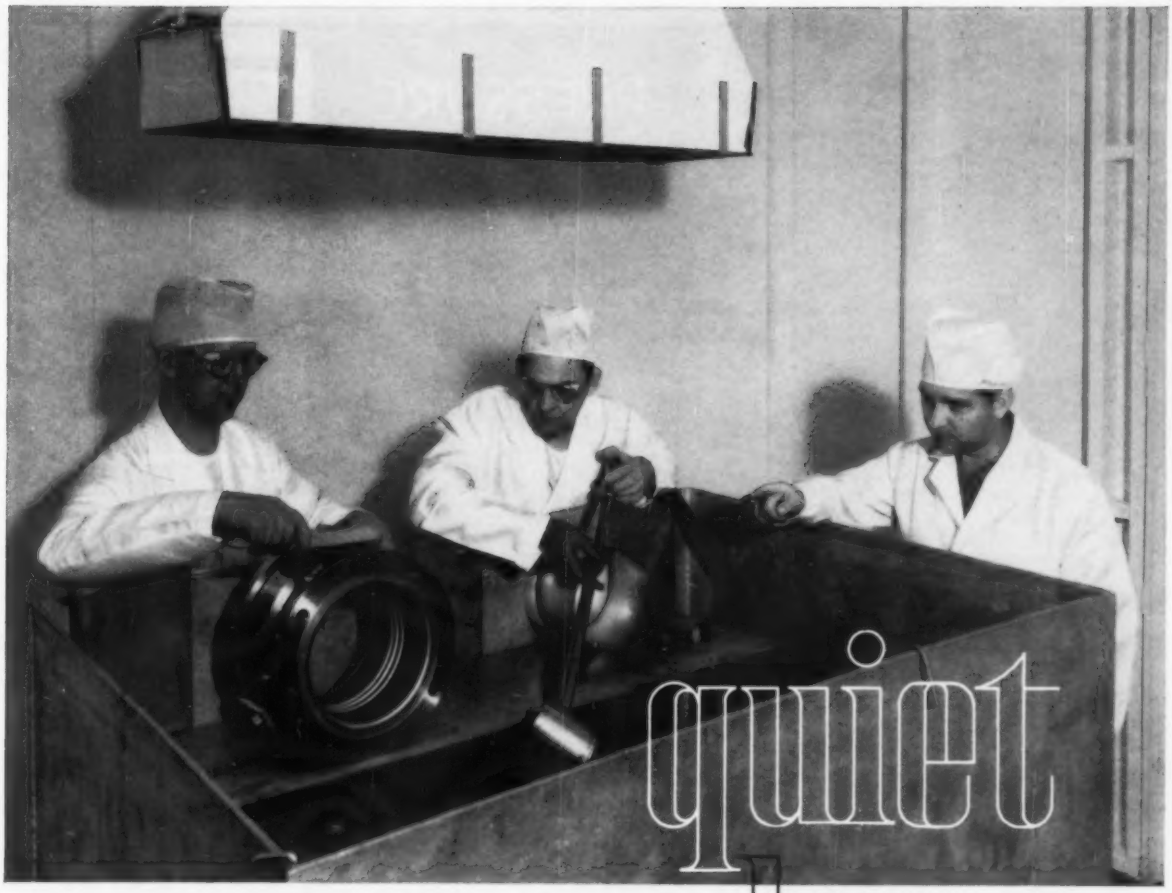

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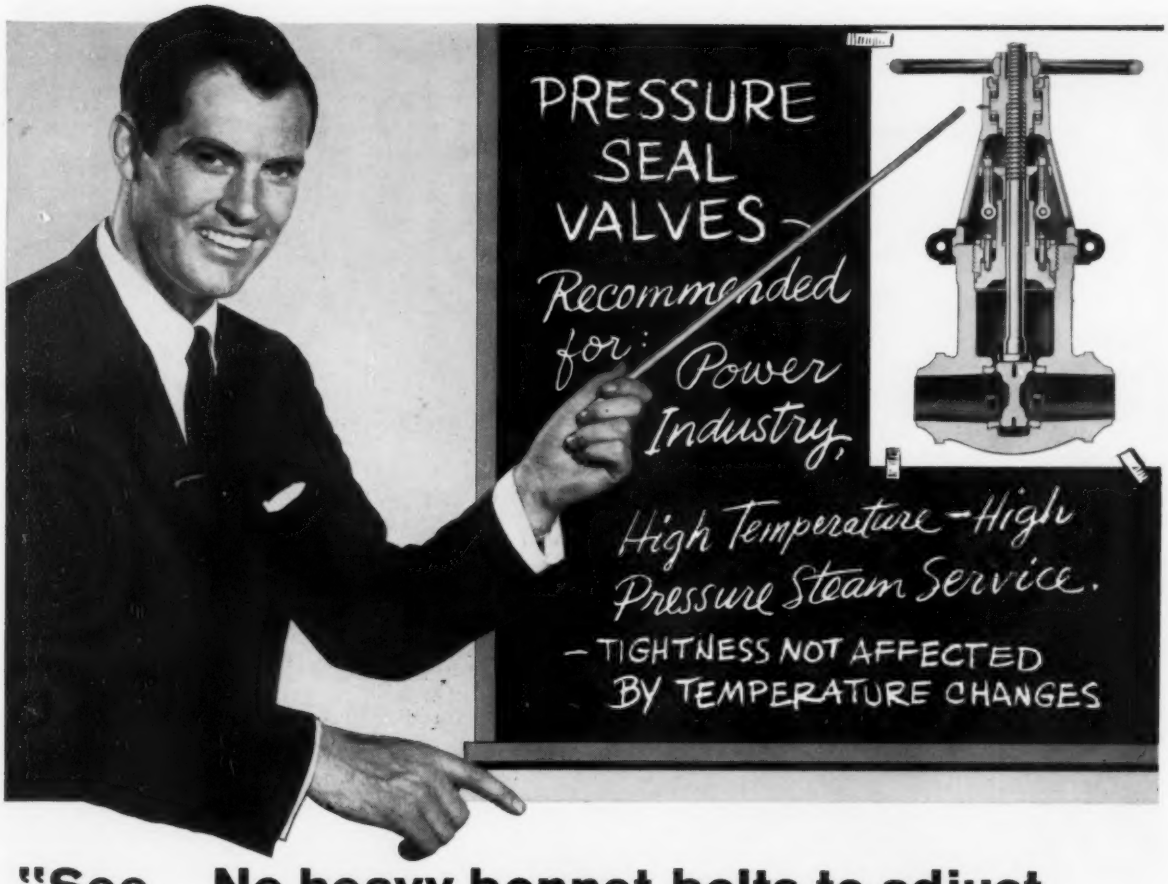

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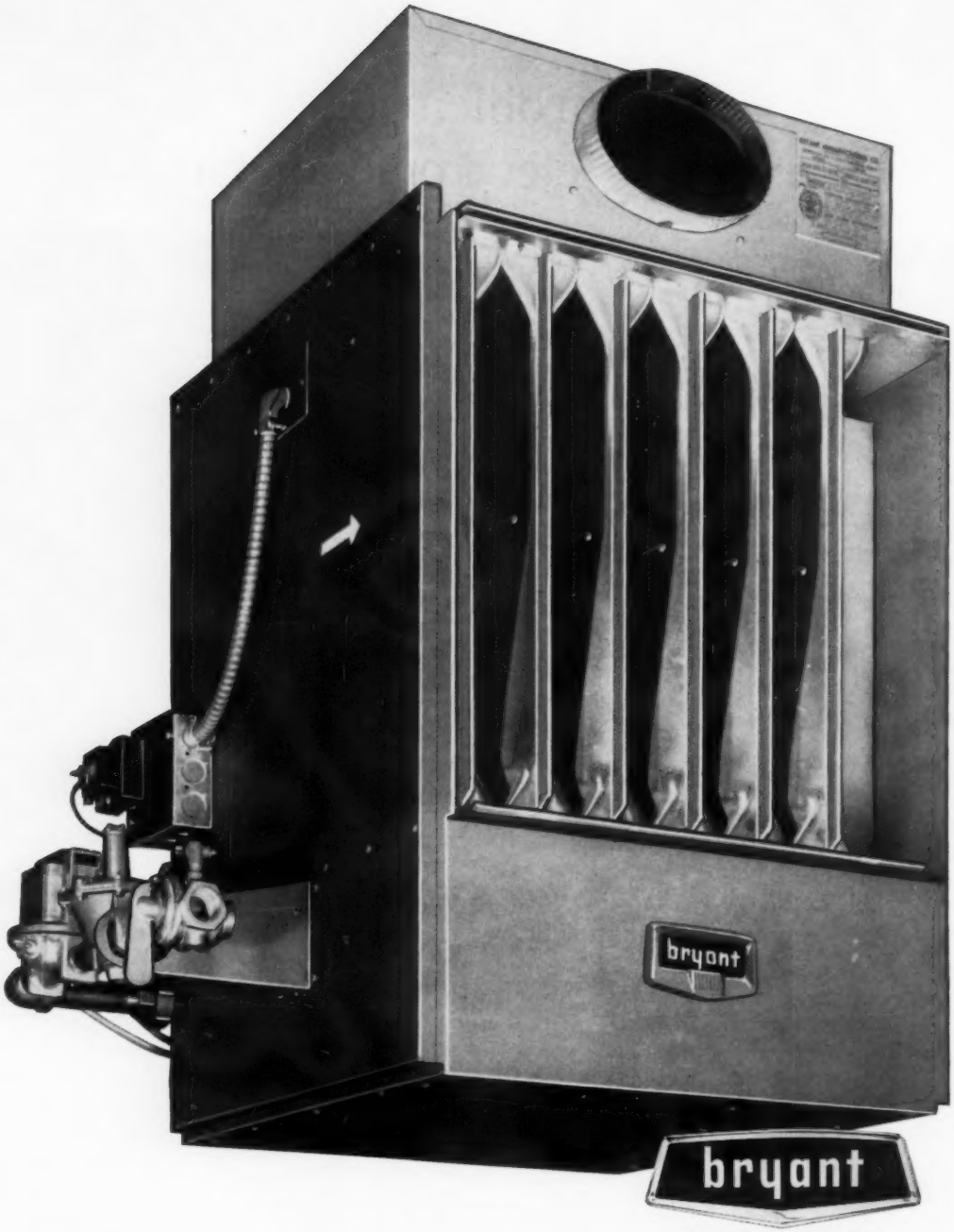

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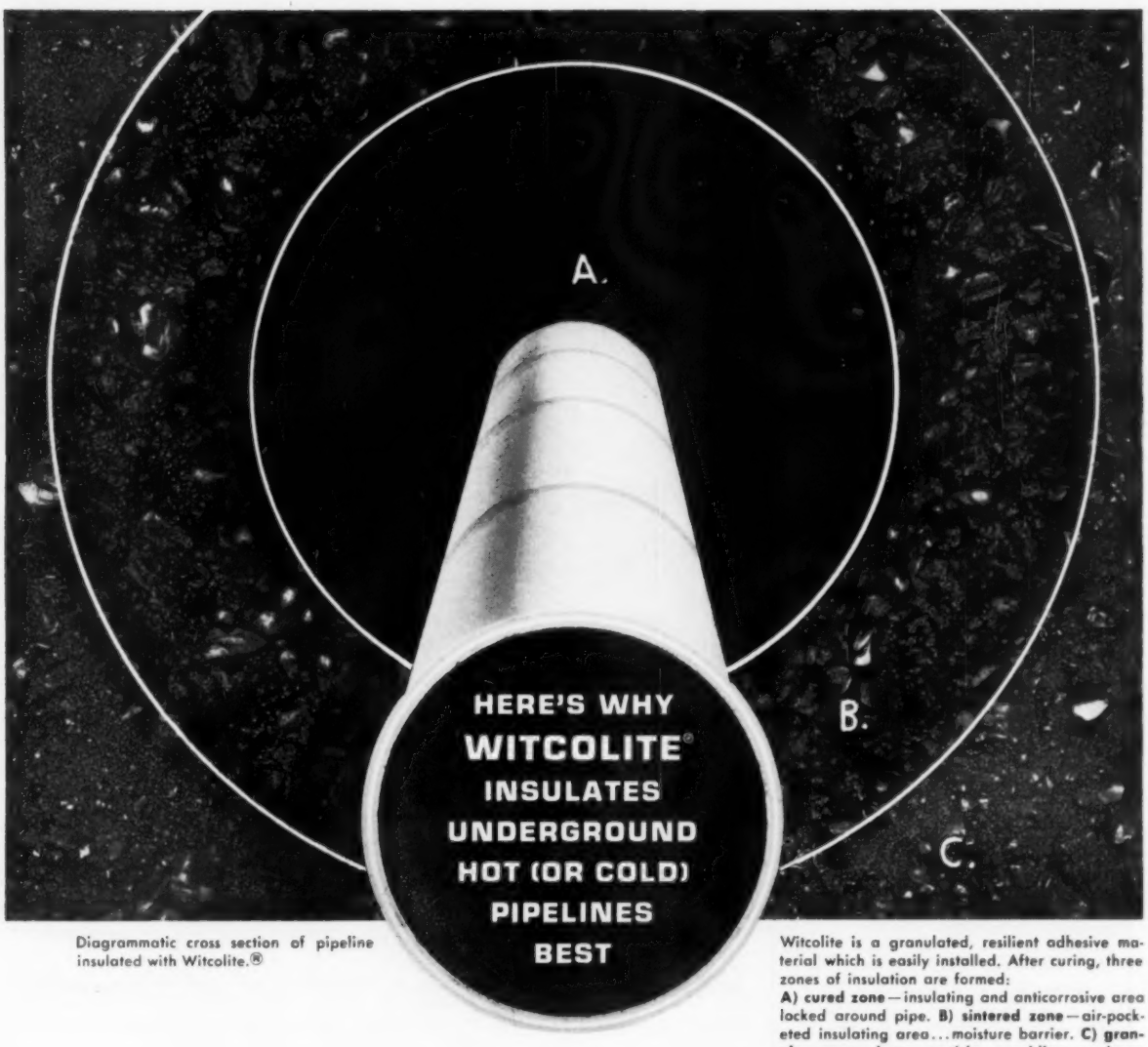

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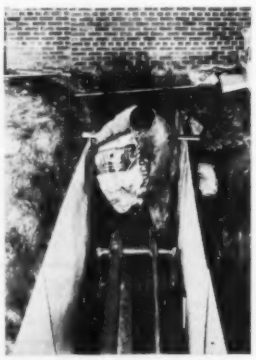

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Continued

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Air Distribution System Features Perforated Diffuser

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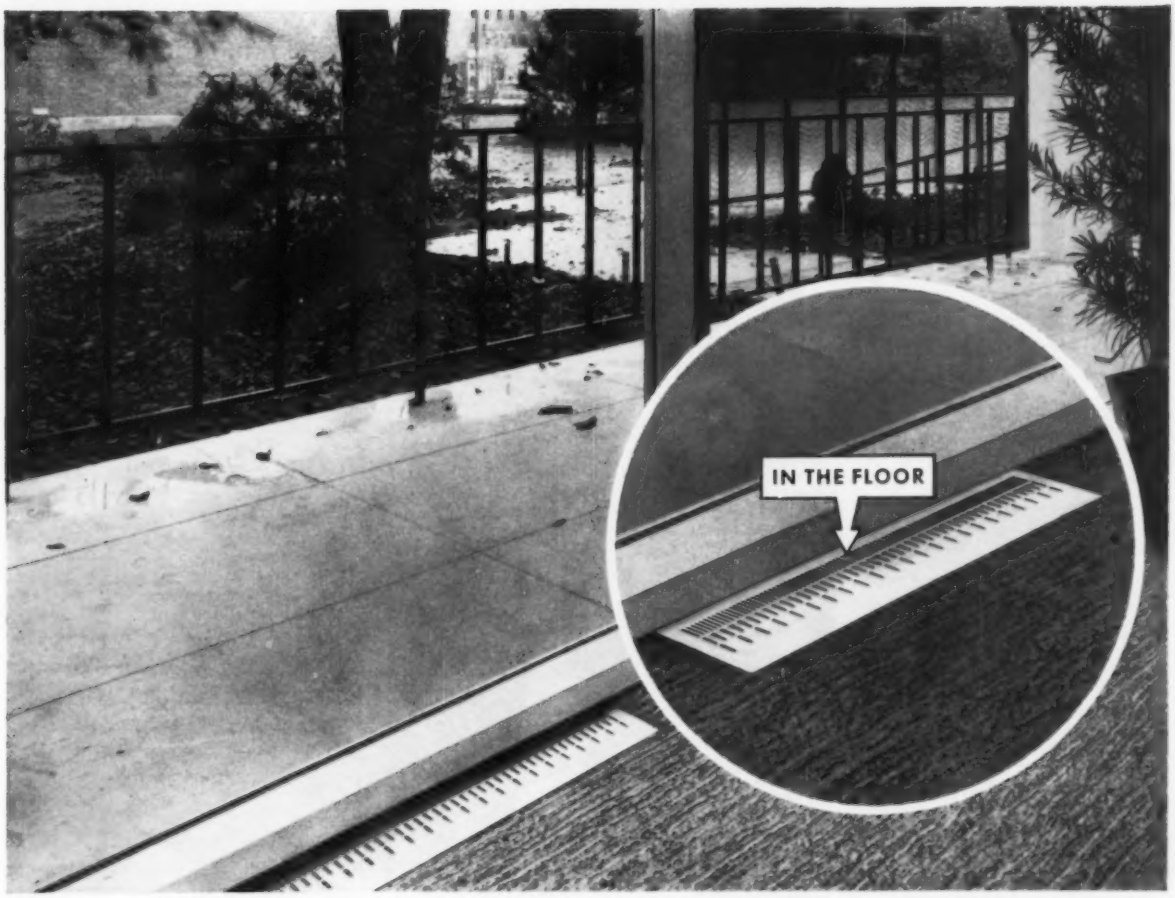
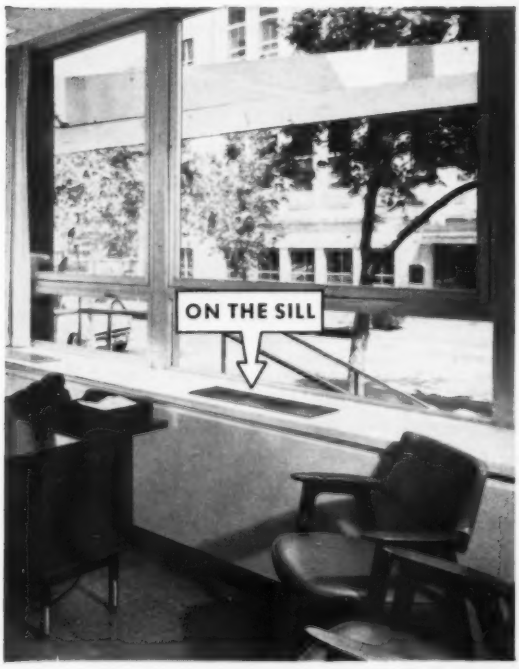


New Anemostat Stainless Steel Diffus-A-Plate



• withstands heavy traffic

• saves space

• provides excellent air diffusion

Anemostat Diffus-A-Plates for floor or sill application diffuse a pattern of conditioned air up the exterior wall and across the ceiling, insuring draftless comfort in the occupied zone.

Suitable for heating, ventilating and cooling. Induction type Diffus-A-Plates can be used as separate units or in continuous sections. Due to the design of the discharge openings which measure 1 inch by ¼ inch, these ruggedly constructed diffusers are heel and pencil proof.

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EQUIPMENT DEVELOPMENTS

Continued

Electric Motors Provide Multiple Constant Speeds

Available in two, three, and four speeds, with variable torque, constant torque, and constant horsepower models. Motors rated from 1 to 100 hp; are a-c; two or three phase; open, enclosed, or explosion-proof; and have speeds from 3600 down to 450 rpm. Bulletins 1005 and 1015 sent on request. — *Howell Electric Motors Co.*, 16316 *W. Seven Mile Rd., Detroit* 35.

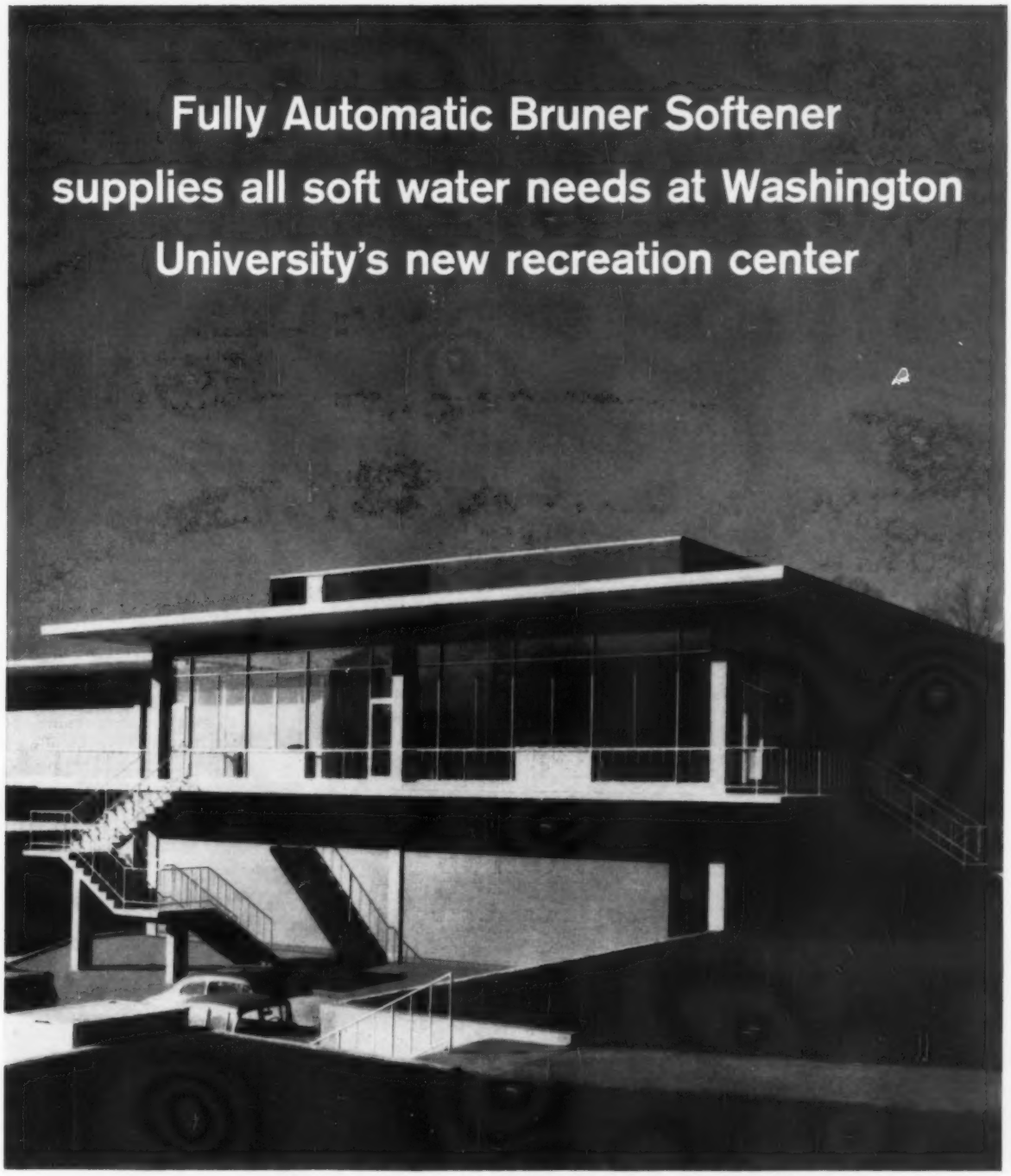
Packaged Ventilating Fans Available in Seven Models

For commercial, industrial, and institutional buildings. Seven direct drive models ranging from 12 to 31 in. sq. Made of aluminum, fans are available with a variety of 60-cycle motors. Rubber isolators assure quiet operation, along with four sound ratings available for different types of buildings. Automatic, motorized, and manual weather-stripped wall shutters available. — *Modine Mfg. Co.*, 1500 *DeKoven Ave., Racine, Wis.*

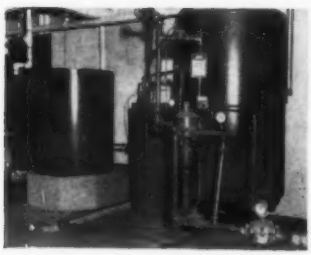
Portable Masonry Drill Has Vacuum Holding Base

For drilling holes from 1 through 12 in. in all building materials. Gear and rack mechanism allows rapid-feeding and retraction of bit while drilling. Vacuum base has holding pressure of 2000 lb. Unit equipped with a high torque electric motor and water swivel. Literature sent on request. — *Molco Drilling Machines, Inc.*, 909 *Franklin St., N.E., Washington, D.C.*

Fully Automatic Bruner Softener supplies all soft water needs at Washington University's new recreation center



Architects for the Center: Hellmuth, Obata & Kassabaum, Inc., St. Louis Mo.
Plumbing contractor: E. J. Fischer Plumbing Co., St. Louis, Mo.



Bruner has provided the first water softener on the University campus in St. Louis for the David P. Wohl Center, a dining and recreation hall able to serve 1200 students 3 times a day. This fully automatic Bruner water softener features a reset head meter and automatic by-pass for ease of operation and maintenance, providing soft water for washing over 4000 dishes daily. Here, and across the U.S., leading engineers specify Bruner water softeners, America's most complete line.

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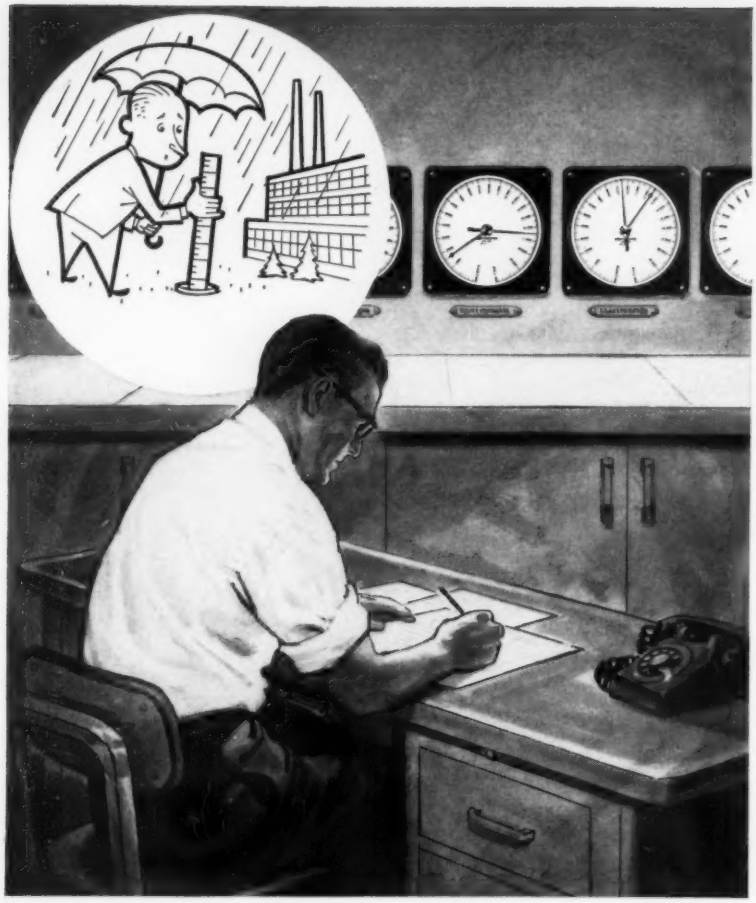

Take the legwork out of liquid measurement

Here's practical liquid measuring—the modern way... without roaming all over the lot! Liquidometer Gauges let you inventory distantly stored liquids at a glance.

Completely automatic Liquidometer Gauges can be located as far as 250 feet from tanks. Think what this centralized system can mean in man-hours saved—let alone the additional safety of personnel who no longer have to trudge to, or tamper with, hard-to-get-at tanks.

Simple to install, and requiring no maintenance, Liquidometer Gauges measure virtually all liquids conveniently, continuously, and correctly. There's a type available for practically every liquid measuring application.

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THE LIQUIDOMETER CORP.

Dept. A, LONG ISLAND CITY 1, NEW YORK

EQUIPMENT DEVELOPMENTS

Continued

Boiler Controller Provides Modulating, Sequencing Features

A modulating, lead-lag sequence control system in a single enclosure for automatically operating a bank of boilers, compressors, or other units. Responds to pre-determined pressure or temperature variations, or any signal. Lead unit selectable at any time by turning an externally accessible rotary switch; lag units follow in numerical sequence. Bulletin MM-1010 sent on request. — *Cleveland Controls, Inc.*, 1111 *Brookpark Rd., Cleveland* 9.

Infrared Gas Heater For Natural, LP Gas

Overhead unit for high ceiling industrial and commercial buildings. Unit operates on natural or LP gas, with a capacity of 35,100 Btu per hr. Control is automatic by a thermostat. Cone-shaped, stainless steel, infrared heat emitter is perforated for maximum heat transfer. Unit is 16 in. high, with a diameter of 33 in., and weighs 33 lb. — *Space-Ray Corp., P.O. Box* 3485, *Charlotte, N.C.*

Packaged Air Conditioner For Roof Installation

Available in 7½ and 10 ton cooling capacities with heating outputs from 163,000 to 272,000 Btu per hr. Can be controlled by one heating-cooling thermostat or applied to two zones, each controlled by a separate thermostat. Automatically controlled outside air (up to 100 percent) available for ventilation. — *Lennox Industries Inc., Marshalltown, Ia.*

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PER DOLLAR
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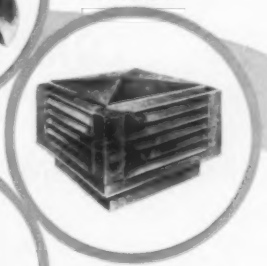
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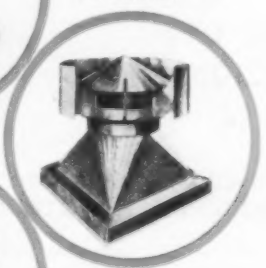
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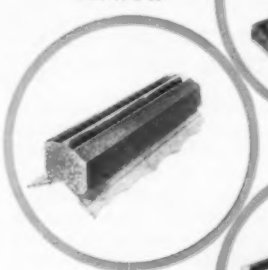
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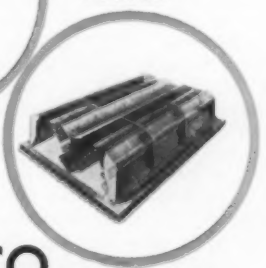
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Low construction and installation costs, through the interlocking principle of design, make OCTAGON roof ventilators the logical choice for industrial, commercial and institutional buildings. The wide variety of ventilators includes exhausters and intakes, power or gravity types, high or low velocity, vertical or horizontal air motion.

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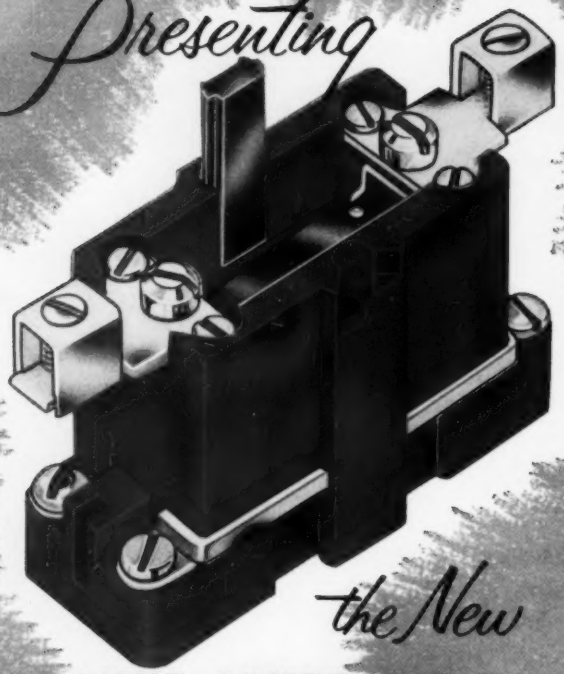
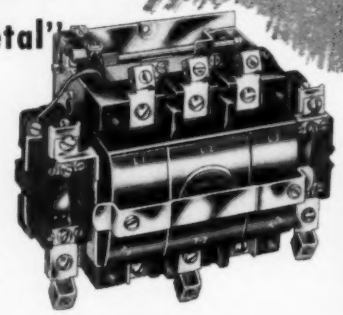


the New

AMBIENT COMPENSATED OVERLOAD RELAY with "Balancing Bi-Metal" Exclusive with ARROW-HART



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For use with forced air furnaces, stokers, and year around air conditioning units. May be precisely adjusted in small increments, and cannot slip out of adjustment. Maximum variation of speed, 30 percent in five turns. Pulley design eliminates parallel and angular misalignment. Static and dynamic balance held to 0.125 in.-oz. Available in ½, ⅝, and ¾ in bores, and handles 3L, 4L, and 5L belts.— *Congress Drives Div., Tann Corp., 3750 E. Outer Dr., Detroit 34.*

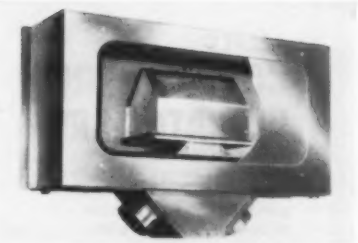
Cooling Towers Feature Centrifugal, Propeller Fans

Two blow-through models: a standard centrifugal-fan tower in capacities from 10 to 800 tons; and a multistage propeller-fan tower with low-operating horsepower. — *Baltimore Aircoil Co., Inc., P.O. Box 7322, Baltimore 27.*

Clamp Couplings Have All Bolts on Top

To fit all common sizes of cast iron, asbestos-cement, and steel pipe through 8 in. nominal. Nuts grouped for fast rotational tighting; no separate parts to shift and match up. Recessed armor and finely gridded gasket give permanent leak protection. Double-radius head heat treated bolts, grade 35018 malleable iron lugs, and type 302 stainless steel used for corrosion protection. — *Smith-Blair, Inc., 535 Railroad Ave., South San Francisco.*

One little spring controls air volume in Buensod's Dual-Duct high velocity air mixers. And it does the job automatically all year 'round with no maintenance, no fuss, no attention. Zoning requirements are met by pre-setting units at the factory, by adjustment on installation, or if a change is ever required, by the simple manipulation of screw driver on retaining screw. Too simple? Why complicate life! Buensod-Stacey pioneered and developed Dual-Duct to its present state of perfection . . . an all year temperature and humidity control system for care-free comfort in new buildings or renovations.



Buensod-Stacey Type V under-window unit.

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- **Absorb and isolate vibration.**
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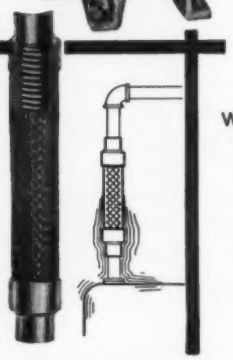

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EQUIPMENT DEVELOPMENTS

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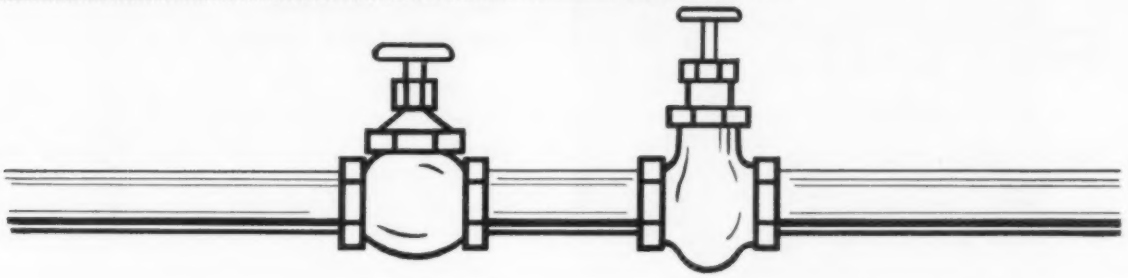
Portable Masonry Drill Features Four Spindle Speeds

Concrete core drill for holes 1 to 10 in. in diameter, with spindle speeds of 500, 1000, 1500, and 2500 rpm. Vacuum unit available to hold machine in position with 3000 psi pressure. Powered by 5 hp electric motor, three phase, 220/440 v. Made of cast aluminum and steel, unit weighs 275 lb. Bulletin sent on request. — *The Kor-it Co., Inc., 991 Richard Ave., Santa Clara, Calif.*

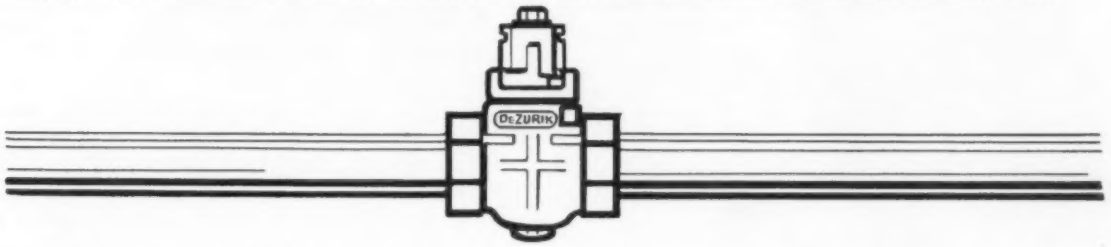
Contactors, Starters for Air Conditioning Equipment

Small 30 and 40 amp contactors and starters handle up to 600 v for compressor motor and special panel mounting applications. Features dust resistant vertical contacts, optional push-on coil terminals, and three-point keyhole-mounted baseplates. Can be furnished with quick-trip or standard overload relays. 30 amp units rated at 30 amp, 220 v, or 15 amp at 440/550 v; 40 amp forms rated 40 amp at 220 v, or 20 amp at 440/550 v. — *General Electric Co., Schenectady 5, N.Y.*

WHY USE TWO...



WHERE ONE WILL DO?



DeZurik Valves installed on balancing service will throttle precisely.... shut dead tight....and open to the balanced position again....without dial settings or re-balancing!

A DeZurik Balancing Valve, with its ability to throttle precisely, without chatter, and to shut off, without leakage, represents a sizeable reduction in the number of valves required for air conditioning systems.

With DeZurik Balancing Valves, once the system has been balanced, the adjustable Stop Ring is rotated to bring the Open Position Stop against the Stop Lug. When the clamping screw is tightened, the balanced position is positively identified!

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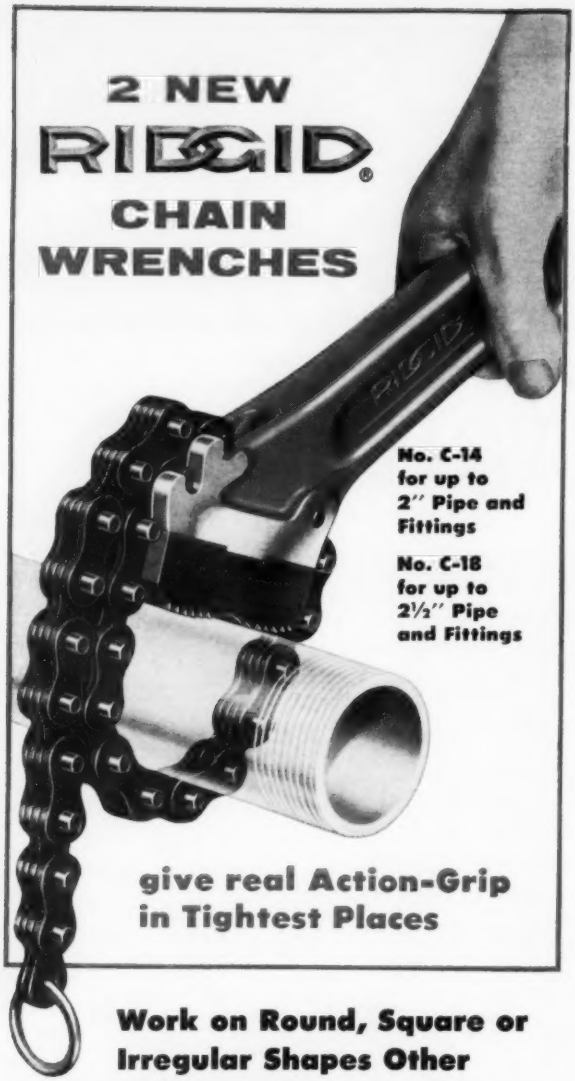
As a matter of fact, DeZurik Balancing Valves can save you time and money right from the start. They are drilled and tapped for a pressure gage, eliminating the expense of drilling and tapping, or welding the pipe.

Why use a gate and globe combination, when *one* DeZurik Valve does the job so much better!

Write for details on DeZurik Balancing Valves or contact the DeZurik representative in your area.

DeZURIK CORPORATION
SARTELL, MINNESOTA



Work on Round, Square or Irregular Shapes Other Wrenches Can't Reach!

In extra close quarters, there's nothing that'll beat these new RIDGID Chain Wrenches for getting the job done. Fast, ratchet-like action in either direction . . . from either side. Give tight grip without crushing. Large, easy-to-grab end ring for fast chain adjustment. Tempered steel chain locks securely . . . releases quickly. Rugged, comfort-grip, I-beam handle, guaranteed not to break or warp . . . handy hang-up hole.

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EQUIPMENT DEVELOPMENTS

Continued

Hot Water Circulator For Multi-Zoned Circuits

"Even-Flow" unit features shut-off head of 14.5 ft of water and a flat characteristic curve, allowing multi-zoned application with one circulator. Developed head 13.2 ft at 10 gpm and 10.0 ft at 30 gpm. Stainless steel impeller and hardened stainless steel shaft prevent corrosion, rust, and cavitation. — *Edwards Engineering Corp., Pompton Plains, N.J.*

Flexible Tubing for Aircraft Air Conditioning

"Feather-Flex" tubing for air conditioning duct in aircraft has nylon helix, reducing weight. For either hot or cold air, temperature range from −40 to 200 F. Can be squeezed through small openings and retains shape on other side. Can withstand as much as 100 percent deformation without harm. — *Flexible Tubing Corp., Guilford 2, Conn.*

High Temperature Fans Feature Air-Cooled Shaft

"Thermal-Aire" fans for ovens, kilns, furnaces, dryers, and similar applications for operating temperatures up to 1700 F. Nickel chromium stainless steel air-cooled shaft, standard equipment. Shaft has integral chamber-and-slot arrangement, reducing transmission of heat. — *Garden City Fan & Blower Co., 801 N. Eighth St., Niles, Mich.*

Power Conversion Burners For Natural, Mixed Gas

"Fire Power" units especially suited for firing Scotch Marine boilers and large warm air furnaces. Four models with gas input ratings of from 300,000 to 1,600,000 Btu per hr. "Tube within a tube" design allows burner to throughly meter and mix air and fuel. Operates on a 115 v, 60 cycle, 1725 rpm motor. Specification sheets sent on request. — *The Carlin Co., 912 Silas Deane Hwy., Wethersfield 9, Conn.*

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- Beaded Tubes
- Easy Access to Firing Surfaces
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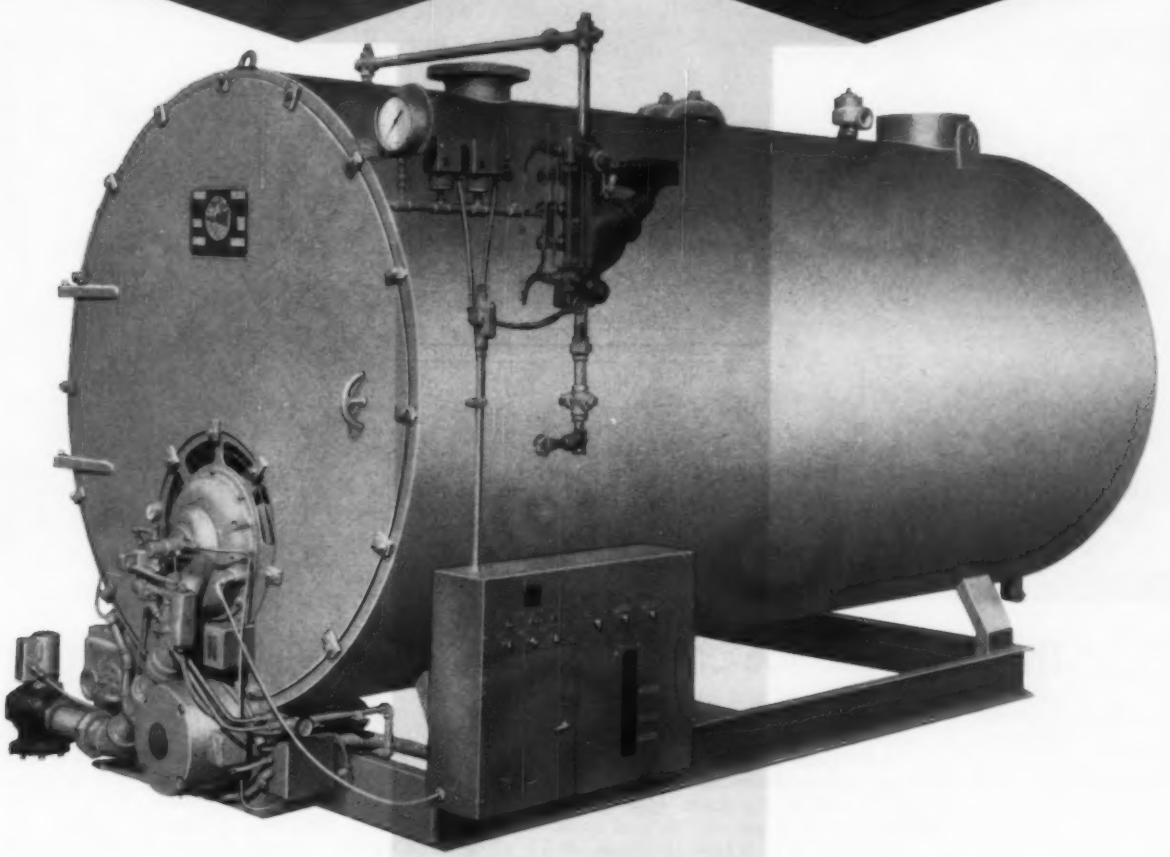

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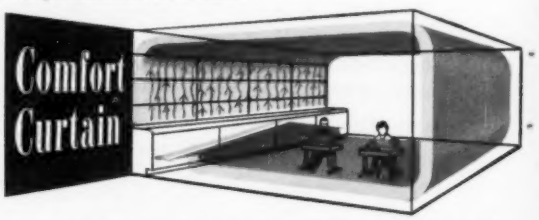
COMFORT CURTAIN® gives true perimeter air distribution—at uniform velocity—*along the entire exterior wall* of any classroom. This curtain of moving air blankets the entire outer wall and windows. It sets all the air in the room into gentle motion—to eliminate cold spots, drafts and areas of "tired" air. A processing unit in each classroom controls, blends and filters warm air, fresh outdoor air, and return air as demanded by conditions in that particular room. "Day-nite" thermostats, with non-occupancy settings, control these units to permit substantial fuel savings and economical after-hour use of individual rooms. The minimum structural requirements of COMFORT CURTAIN and its ease of installation reduce both initial and over-all costs. Servicing is handled by a qualified local heating contractor. For complete information about the COMFORT CURTAIN System and its use with all types of heat sources, write LENNOX, 539 S. 12th Ave., Marshalltown, Iowa. If more convenient call your nearest Lennox office, listed below, and ask for a technical representative to call.

LENNOX®



©1961 Lennox Industries Inc., founded 1895; Marshalltown and Des Moines, Ia.; Syracuse, N. Y.; Columbus, O.; Decatur, Ga.; Ft. Worth; Los Angeles; Salt Lake City. In Canada: Toronto, Calgary, Montreal, Vancouver, Winnipeg.

...Only

LENNOX

Comfort Curtain® provides full room ventilation

$1.19 per sq. ft. provides full perimeter air distribution—with fresh air ventilation and heating—in the 12 classrooms of this school.

Eugene Field Elementary School
Springfield, Missouri
Matthews and Hillman, Architects & Engineers

Gas-fired warm air heating sources, with individual prefabricated flues, are located in approved construction heater rooms between each two classrooms. This eliminates the need for a central heating plant and expensive duct or pipe systems. Simple exterior wall openings admit outside air to the processing units in each classroom. Pre-finished bookshelf duct sections provide full perimeter air distribution along the entire length of each classroom's exterior wall. Individual thermostats permit maintenance of room temperatures within ½° of setting. Modular design enables new units to be added economically with future building expansion.

EQUIPMENT DEVELOPMENTS

Continued

Basket Strainers Protect Pumps, Valves, Regulators

Units used in steam, air, oil, gas, and chemical lines, for most suction and high or low pressure installations. Semi-steel and cast steel units have clamped or bolted covers. Bolted covers suitable for pressures up to 600 psi at 800 F. Sizes range from 2 to 16 in. with flanging from 125 to 300 lb. Baskets made of brass or stainless steel with 3/32 in. perforations. Bulletin SM-70 sent on request. — *Strong, Carlisle & Hammond, 509 Sandusky St., Conneaut, O.*

Pipe Guides, Supports For Expansion Joint Use

Each pipe guide consists of a cast steel segmented spider, sized to OD of pipe from ¾ to 24 in. nominal size, free to move axially in a segmented steel cylinder. Roller pipe supports made of steel, standard sizes available for pipe from ¾ to 14 in., with larger sizes available. Engineering Guide No. 222-C sent on request. — *Flexonics Corp., 290 E. Devon Rd., Bartlett, Ill.*

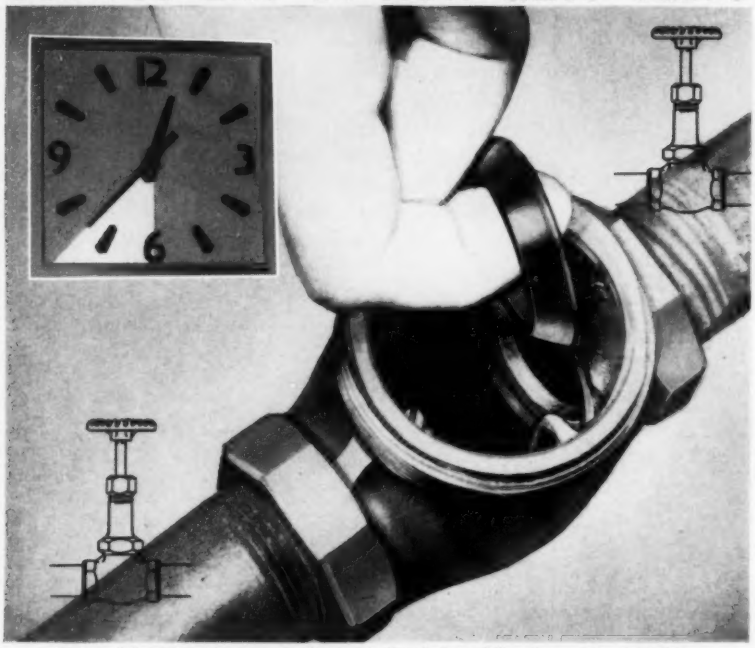
Plastic Roof Ventilators Exhaust Corrosive Fumes

All parts of unit in contact with fumes, including the impeller, made of solid plastic. Impeller driven with either direct or V-belt drive and has adjustable screw to take-up belt. Available in 10 standard sizes ranging from 6 to 30 in. with either plain, collar, or flanged inlet. Data Sheet No. E-7801 sent on request. — *Heil Process Equipment Corp., 12850 Elmwood Ave., Cleveland 11.*

Air Impact Wrench For Heavy Duty Service

A 1 in. square-drive unit has high speed and torque, and fast run down. Air entry through ½ in. inlet, allowing greater air movement. Reversing valve with related volume control for right hand operation is leakproof. Unit provides for horizontal or vertical suspension. An auxiliary handle can be moved to four positions. — *Albertson & Co., Inc., 2801-2999 Floyd Blvd., Sioux City 2, Ia.*

Only 7 to 10 Minutes to Renew Service Life of New Gate Valve



Patented development assures replacement of seat ring while valve remains installed.

Without removing the valve body from the line, you replace the nickel-alloy seat rings in Fairbanks new patented Renewable Seat Ring Gate Valves. In 7 to 10 minutes, from the time the line is shut down until it is put back into operation, you have given a new service life, a new life of dependable tight closure to your valve.

Just 7 to 10 minutes of your maintenance man's time — only 7 to 10 minutes of "down-time" on your steam, water or process piping lines — and you have the equivalent of a new valve in the line. Think of the savings: where once at least one hour, under the most ideal conditions, was required to replace a gate valve in the line, the job is now accomplished in from 7 to 10 minutes.

Field tested for over two years, under all conditions from steam to corrosive liquids, the revolutionary new Fairbanks Renewable Seat Ring Bronze Gate Valve has proven completely satisfactory — absolutely dependable.

Made with either rising stem or non-rising stem construction in ½", ¾", 1", 1¼", 1½" and 2" sizes, the Fairbanks Renewable Seat Ring Bronze Gate Valves are recommended for severe service conditions on 200 lb. steam pressure at 550 degrees F., 400 lb. water, oil or gas pressure — non-shock — lines requiring full flow and subject to frequent operation. Nickel alloy seat rings and wedge make the valves particularly tough and corrosion resistant.

YOURS ON REQUEST: Illustrated, descriptive folder gives complete information on Fairbanks Renewable Seat Ring Gate Valve with details and specifications. Yours without charge. Write today.

THE **Fairbanks** COMPANY
393 Lafayette Street, New York 3, N. Y.
Branches:
New York 3 • Boston 10 • Pittsburgh 22 • Rome, Ga.
Valves • Trucks • Casters • Wheels • Dart & "PIC" Unions

1. Union Bonnet removed. Retaining screw loosened with ordinary screwdriver.

2. Finger hooks inside nickel alloy seat ring. Seat ring lifts out of valve body.

3. New seat ring is inserted. Retaining screw tightened. Bonnet replaced.

EQUIPMENT DEVELOPMENTS

Continued

Maritime Coils for Preheat, Reheat, Cooling

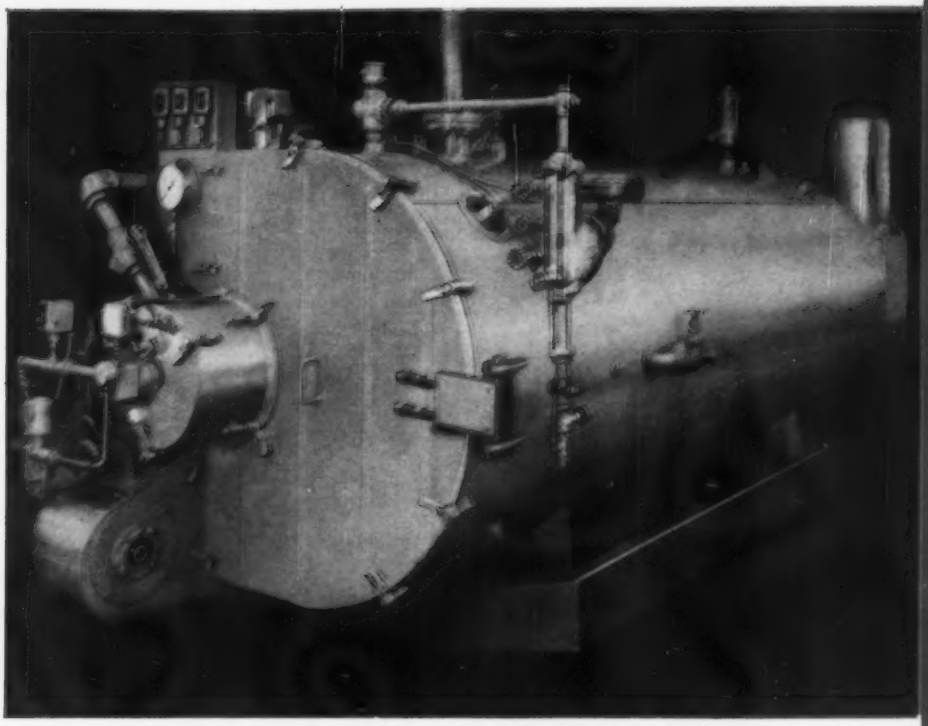
Coils feature four to eight copper fins per in. with self-spacing collars completely covering tubes. Casings of heavy gage galvanized steel with four flanged sides. Headers of heavy-wall seamless copper tubing with end caps. Coils pressure tested at 400 psig. — *Bohn Aluminum & Brass Corp., Danville Div., Danville, Ill.*

Heating, Ventilating Line Includes 102 Standard Units

Units for heating school auditoriums, gymnasiums, and similar applications. "Torrivent" line includes six models of 17 basic sizes with heating capacities from 20,000 to 3,800,000 Btu per hr and air capacities from 600 to 54,000 cfm. Models are horizontal ceiling, horizontal floor, vertical floor, vertical wall, inverted ceiling, and inverted wall. Individual selection can be made of casing and fan section; steam or hot water coils; and accessories. Bulletin DS-327A sent on request. — *The Trane Co., La Crosse, Wis.*

Combustion Indicator Detects Small Changes

Unit detects and indicates changes as small as 5 Btu per hr in fuel gas and ±0.5 percent in air-gas mixtures. Changes in flame configuration also indicated. Unit presamples air-gas mixture. — *Selas Corp. of America, Dresher, Pa.*



Introducing the *Powermaster*® Positive Flow® Boiler

...the greatest advance in packaged firetube boiler design in seven decades!

Here for the first time, is a packaged boiler that gives you an ease of operation, dependability and accessibility often hoped for but never before achieved!

The result of more than two years of development and testing, the *Powermaster Positive Flow* boiler has been tried, tested and proved by one of America's foremost consulting engineer firms. Among its many tried and proven features are: accelerated internal circulation which greatly improves heat absorption efficiency . . . *PyroFlow*® burner system which can be easily converted in the field from/to either oil or gas without burner modification . . . hinged front and rear covers . . . optional dryback or wetback construction . . . quieter operation.

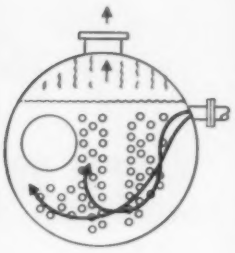
No other boiler can match the performance of the Powermaster Model PF for generating steam or hot water economically and dependably. A comparison of performance tests with other boilers will prove this is no idle statement.

See a demonstration of this highly advanced boiler at the International Heating & Ventilating Exposition in Chicago, Feb. 13-16, Booth 207, or write for Bulletin No. 1275. A leasing arrangement may be made with your local O&S distributor.

ORR & SEMBOWER, INC. BUILDERS OF BETTER BOILERS SINCE 1885

ORR & SEMBOWER, INC.
990 Morgantown Road
Reading, Pa. • Since 1885

Powermaster®
POSITIVE FLOW®
PACKAGED AUTOMATIC BOILERS

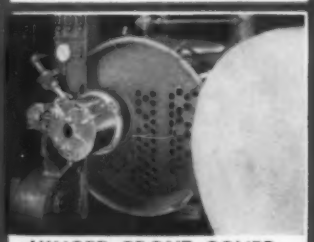


POSITIVE CIRCULATION

Design permits boiler feed injection and natural thermal circulation to augment each other. This provides the maximum water circulating rate and the most efficient form of heat transfer, **counterflow**.

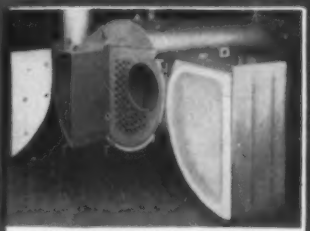
SIDE LOCATED FURNACE

Side located furnace eliminates danger of heat damage due to stagnant water and sludge. Turn-around spaces are simple, accessible and positive sealed.



HINGED FRONT COVER

Hinged front cover, with quick-opening fasteners (no bolts) can be opened for access to heating surface without disturbing burner, wiring or piping.



DIVIDED REAR COVER

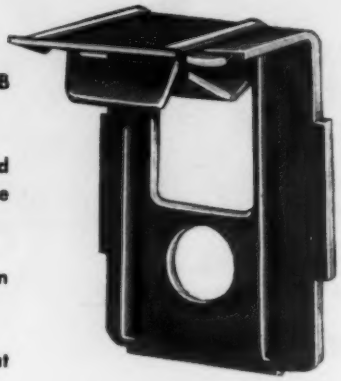
Hinged rear cover, also with quick-opening fasteners, permits ease of accessibility and maintenance. Each cover section forms a separate seal in a single plane, providing protection from short-circuiting of combustion gases. No internal baffles to leak.

GAT®

TAP-ON HANGER

For Suspension from BULB TEES

CAT. NO. 2-H-4



- TAP-ON fits any and all BULB TEE (3/32"—9/64").
- TAP-ON design permits fast and easy installation regardless of the insulation material used.
- Ceiling material not defaced when applied.
- TAP-ON in-place cost is ½ that of other methods.
- Made from heat-treated spring steel and coated with rust proof finish.
- Recommended for load limits up to and including 150 lbs. per hanger based on 4-1 safety factor.

PLACE ON

TAP WITH HAMMER

TYPICAL APPLICATIONS

#8 WIRE & SMALLER

SUSPENSION CHAIN

SHEET METAL STRAP

GEO. A. TINNERMAN GAT® FASTENERS FOR THE CONSTRUCTION INDUSTRY

Exclusive Distributors ERICO CADWELD PRODUCTS, INC.
2070 EAST 61st PLACE • CLEVELAND 3, OHIO

EQUIPMENT DEVELOPMENTS

Continued

Ventilating System Recirculates, Exhausts

Three-position reversing switch controls direction of fan. Fan blows air downward on recirculating cycle and pulls air up and forces it out of building on exhaust. A damper seals unit in winter. Sizes range from 3000 to 23,000 cfm. — *Genie-Air Products, 3001 E. 11th St., Los Angeles, Calif.*

Colored Housings for Roof Exhaust Fans

"Fiberglas" units in six colors: dark blue, light blue, tangerine, buff, gray, and white for use with firm's fans from sizes "6PC through 56PC." Withstands heat, cold, moisture, and fumes; also controls sound. — *Davidson Fan Co., Dept. 14, 213 California St., Newton 58, Mass.*

Sealers Incorporate Rubber Characteristics

"Pliogrip" seam sealer, protective coating, and caulking compound incorporate protective and elastic characteristics of synthetic, chemical rubber. Products based on an aluminum fortified adhesive formula. Manufactured by Goodyear Tire & Rubber Co. Descriptive literature available. — *Campbell-Odell, Inc., 856 W. 69th St., Chicago 21.*

HENRY VALVE CO.

CONTROLLING FLOW SINCE 1914

"DRI-COR"® the High Flow... High Drying Capacity... Acid Removing... Refrigerant Filter-Drier with Granular Desiccant and Advanced Design Molded Core

The only molded core made by ceramic bonding of highly efficient desiccant particles. All inert fillers are removed by ceramic fire completely activating the core. Permits maximum flow and depth filtration at minimum pressure drop. Dryness assured by Abso-Dry® pressure sealing and Brass Flare Nuts.

CAPACITY RANGE R-12 up to 20 TONS
R-22 up to 25 TONS

DRI-COR Advanced Molded Core

Design Provides Uniform Core Porosity
No Inactive Cement or Binder

DRI-COR Two Stage Drying

Progressive Filtration . . .
500 P.S.I. Working Pressure

DRI-COR Drying And Filtering

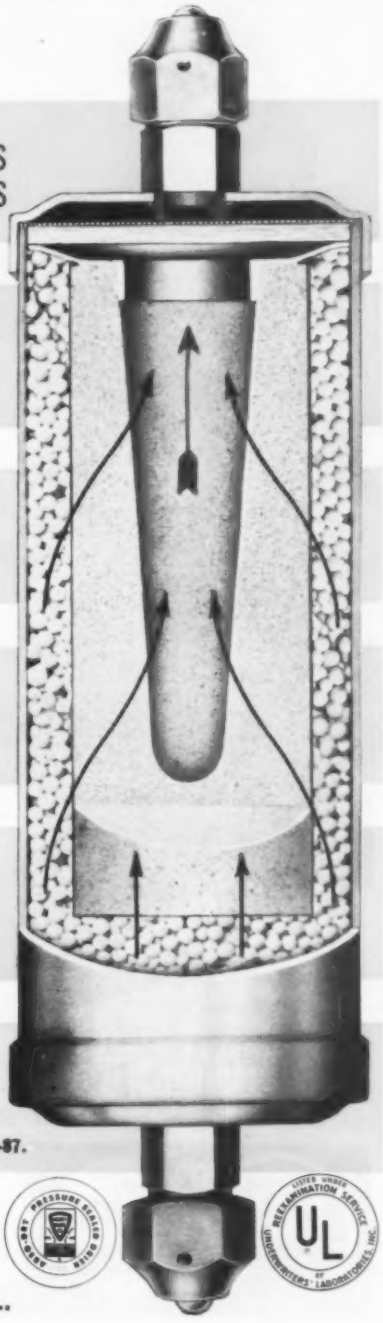
Properly Proportioned . . .
Complete range of sizes

DRI-COR Low Pressure Drop

Transverse Flow for Rapid Moisture and Acid Adsorption

DRI-COR Pressure Sealed

Permits Continued Desiccant Reactivation Prior to Use



Also Available in Replaceable Cartridge Types . . . Write for DRI-COR bulletin V-87.

HENRY VALVE COMPANY

For Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILLINOIS, U.S.A. CABLE: HEVALCO, MELROSE PARK, ILL.

LAU

SERIES A
22", 25" and 30"

DESIGNED FOR COMMERCIAL INSTALLATIONS

Built-in flexibility makes the Lau "Series A" the number one choice for commercial and industrial installations. With a C.F.M. range of from 8,000 to 36,000, this efficient unit may be used in many different sizes and types of air conditioning systems. For even greater C.F.M. capacity and flexibility the "Series A" may be operated in banks of two or three.

The "Series A" features such quality Lau parts as heavy gauge riveted wheels, large reservoir oil type bearings and sturdy angle framing for housing supports and structural strength. "Series A" blowers provide for either top or rear mounting motor.

Call or write Lau today for more complete and detailed information.

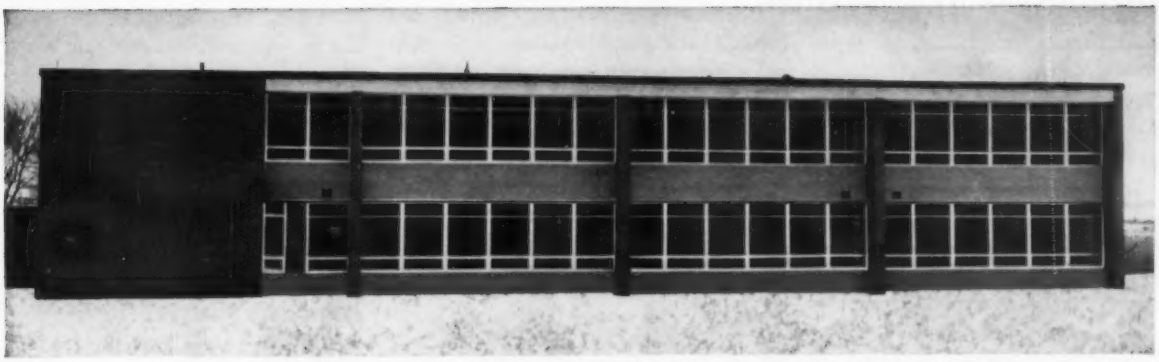
MEMBER INDOOR COMFORT

The Lau Blower Company, 2027 Home Avenue, Dayton 7, Ohio.

Other plants in Kitchener, Ont., Can., and Irwindale, Calif.

LAU

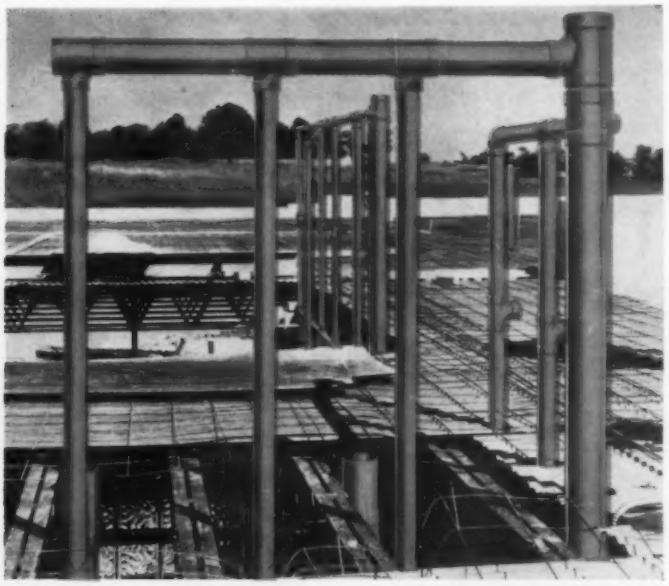
World's Largest manufacturers of Air-Conditioning Blowers for



GOWER SCHOOL ADDITION, Hinsdale, Illinois. *Architect:* Wight & Schlaebitz, Downers Grove, Illinois.
Plumbing and heating contractor: Jerry & Phil's Plumbing & Heating, Inc., Brookfield, Illinois.

SUPERIOR ALL-COPPER PLUMBING IN THIS SCHOOL AT LOWER COST TO TAXPAYERS

COPPER SANITARY DRAINAGE LINES roughed-in among structural members at Gower School. This space-saving installation would have been impracticable with heavy, bulky pipe requiring threaded or caulked joints.



COPPER SANITARY DRAINAGE LINES for second floor lavatories at the Gower School. Light weight of copper tube and ease of making solder joints save many dollars on multiple installations like this. Compact assemblies eliminate wide plumbing walls, give greater usable floor area.

Phil Bergeron and Jerry Wehrmeister, plumbing contractors near Chicago, have found that the installation economies with copper tube and solder-joint fittings enable them to offer all-copper plumbing—water supply *and* sanitary drainage—at a cost lower than competitive bids based on installing ferrous piping. Recent jobs awarded to them as low bidder include the Gower School, the LaGrange Township Junior High School, a church, health center, two restaurants and a store. Anaconda was used for all these jobs. Phil Bergeron says, "We specify Anaconda Copper Tube and Fittings because their consistent fine quality and close tolerances makes our work easier and keeps the job costs within our estimates."

Contractors, builders, and architects the country over are finding that they can provide long-lasting, low-maintenance all-copper plumbing at a cost competitive with ferrous piping. For information on Anaconda Copper Tube and Fittings, write for a copy of Publication C-33. Address: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

5905L

ANACONDA®

COPPER TUBE AND FITTINGS
Available through plumbing wholesalers
PRODUCTS OF ANACONDA AMERICAN BRASS CO.

EQUIPMENT DEVELOPMENTS
Continued

Metering System Components For Boiler Installations

With controllers, actuators, transmitters, indicators, and manual stations for positioning and metering control of single and multiple boiler installations. Basic transmission system is electronic. Some individual components integrated in single enclosures when multiple functions are desired. Bulletin MS-360 sent on request. — *Cleveland Controls, Inc., 1111 Brookpark Rd., Cleveland 9.*

Moisture Analyzer For Refrigerant Gases

Electrolytic unit consists of two modules: gas sampling module is thermostated and includes a vaporizing valve and oil separator with other components; indicating and control module may be a-c or battery operated. Gives indication of moisture in parts per million of water by volume. Bulletin No. DS-1070 sent on request. — *Manufacturers Engineering and Equipment Corp., York and Sunset Lane, Hatboro, Pa.*

Return Air Grilles With Various Types of Fins

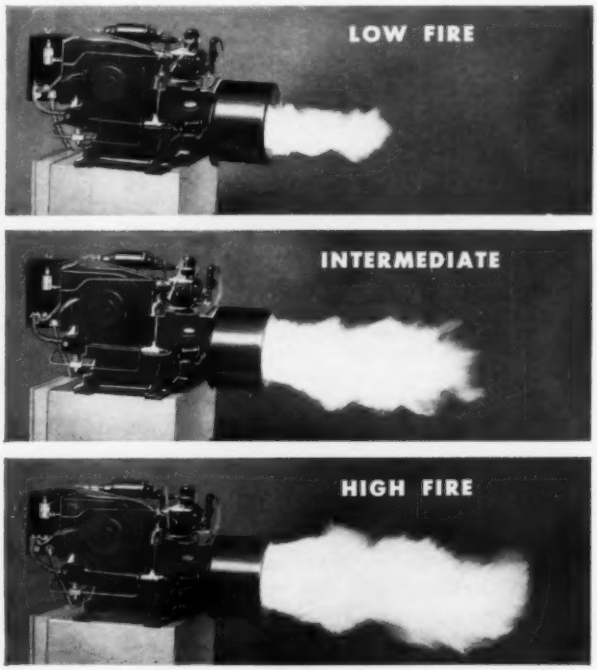
For use in central return air systems, general ventilation, for providing combustion air in utility rooms, ventilation in confined spaces, and return air for perimeter systems. Fins are of angular design, spaced ½ in. apart. Baseboard grilles with horizontal fins in eight sizes; sidewall units with either vertical or horizontal fins in standard sizes through 20 × 24 in. and 30 × 24 in., respectively. —*Hart & Cooley Mfg. Co., Holland, Mich.*

Particulate Analyzer Sizes, Counts Airborne-Particles

For monitoring the presence and distribution of particulate matter in the atmospheres of industrial clean rooms and similar areas. Model "PC-200A" is 31 in. high and displays number of particles present in 15 sub-ranges of sizes from 0.32 to 8.0 microns in diameter. Counts appear visually on decade counters and can be recorded on digital tape or a strip-chart recorder, or both. — *Royco Instruments Inc., 440 Olive St., Palo Alto, Calif.*

Burner does a slow burn

for smooth, economical operation



HEV-E-OIL BURNERS start with a low fire, a small flame which gradually builds up to the required size for safe, smooth operation. Low fire and high fire are controlled exactly to assure top efficiency over the entire firing range. Moreover, Hev-E-Oil burners furnish all the primary and secondary air needed for efficient combustion. Available from 5 to 150 gph. Also combination gas/oil burners from 720,000 to 21,000,000 Btu.

HEV-E-DUTY POWER GAS BURNERS also utilize slow fire build-up for top performance. Air is metered in correct proportion to the amount of gas being used, resulting in high efficiency regardless of chimney draft caused by outside weather conditions. Sizes from 720,000 to 21,000,000 Btu. For more information on Hev-E-Duty Power Gas, Hev-E-Oil and combination burners, write Dept. HPA-21.

INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVENUE
MILWAUKEE 11, WISCONSIN

SEE US AT BOOTH #28 — ASHRAE SHOW — CHICAGO AMPHITHEATRE — February 13 to 16, 1961.

MSA reports on: A Vocabulary of Airborne Particulate Hazards

MSA hopes to stimulate through this discussion a clearer and more orderly interpretation of airborne particulate hazards. This report is directed to those of you in industry who have something to do with the moving and filtering of large volumes of air. A general knowledge of these terms will help us all communicate more effectively. Write us for help in your system recommendations.

DUSTS—Let's define dusts as mechanically generated particulate matter (usually found in the harmful size range of from 1 to 10 microns in diameter). *Nuisance or irritating dusts* have no known specific physiological response. *Fibrosis producing dusts* are local offenders, causing growth of scar tissue in lungs. *Toxic dusts* are general offenders, being systemic poisons. Toxic dusts are of two types: (1) not significantly more toxic than lead: limit of U. S. Bureau of Mines Schedule #21; and (2) more toxic than lead: materials such as Beryllium. *Radioactive dusts* include radioisotopes and inert carriers.

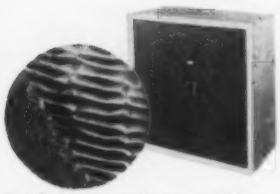
MISTS AND FOGS—Under this category falls liquid particulate (usually found in size ranges of from 5 to 100 microns).

METAL FUMES—Here lie the chemically generated solid particulates (usually generated in a size range of from 0.1 to 1.0 microns).

SMOKES—These particulates are also chemically generated but of organic origin (usually formed in a size range of from 0.01 to 0.3 microns).

LIVING ORGANISMS—Harmful living particulates are classified under this heading. And they in turn include:

Bacteria: one-celled micro-organisms of ½ to 15 microns diameter size range. *Bacteriaphages:* .01 to .5 micron in diameter, depending on degree of clumping. *Virus:* .001 or smaller to 0.3 micron in diameter. *Pollen:* microspores from seed plants (usually found in the size range of from 10 to 70 microns in diameter). *Spores:* reproductive bodies of plants and some one-celled animals about same size as bacteria.

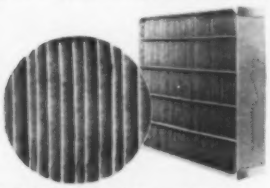


M-S-A® UltraAire* Space Filter

Light weight, fire-resistant, unusually strong, and ideal for high humidity service. Individually pre-tested and proved at least 99.97% efficient in removing particles of 0.3 micron diameter.

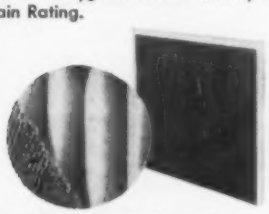
M-S-A® Cylindrical-Type UltraAire* Space Filter

Honeycomb-type fold without separators is admirably suited to cylindrical element construction. This shape is preferred for pressure systems. Weighs only one pound. Easy to handle. Inexpensive to ship.



M-S-A® Dustfoe* Space Filter

Offers the efficiency of an Electrostatic Precipitator without the high cost and without the possibility of arcing "blow-off." 85-95% certified efficiency on NBS Stain Rating.



M-S-A® Air-O-Kay* Prefilter

Impingement type panel prefilter which can be used oiled or dry to remove lint and other large airborne particles from the atmosphere. 60-70% certified efficiency on NBS Stain Rating.

*Trademark

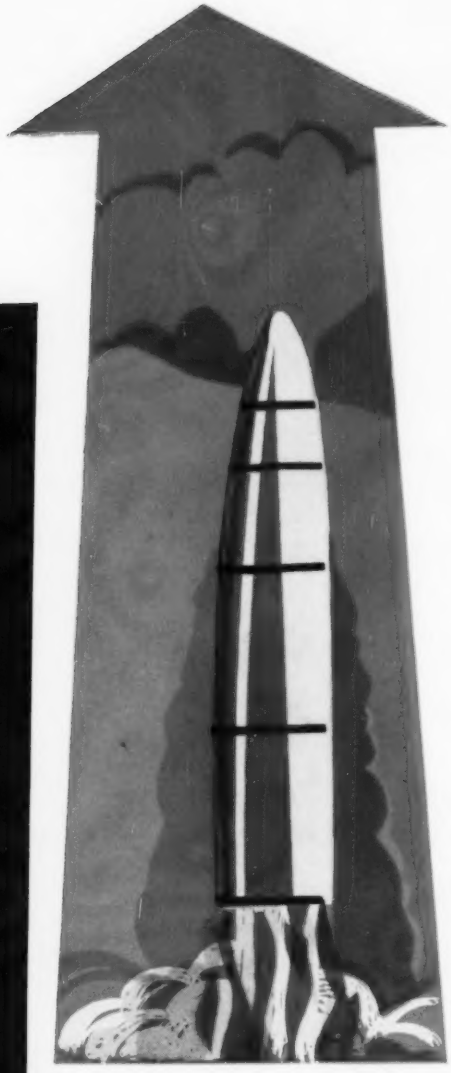
Write for illustrated technical bulletins on M-S-A Space Filters related to your particular system problem. Ask an MSA Representative for system recommendations.

Fluid Purification Specialists for 45 Years

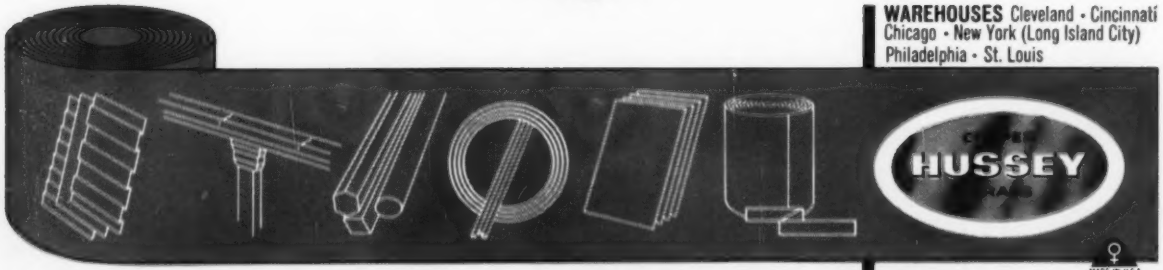
MINE SAFETY APPLIANCES COMPANY

201 North Braddock Avenue, Pittsburgh 8, Pa.

Other Fluid Purification Equipment includes catalytic filters for jet aircraft cabin air; air separation plants; inert gas generators; space capsules; bomb shelters; air line filters; jet fuel and hydraulic fluid purification.



FROM
BUS BAR
TO
BALLISTIC
MISSILES
HUSSEY
COPPER
DOES THE JOB
BEST!



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COPPER RANGE COMPANY

MADE IN U.S.A.
TO THE STANDARDS
OF AMERICAN INDUSTRY

EQUIPMENT DEVELOPMENTS
Continued

Infrared Electric Heaters For Indoor, Outdoor Use

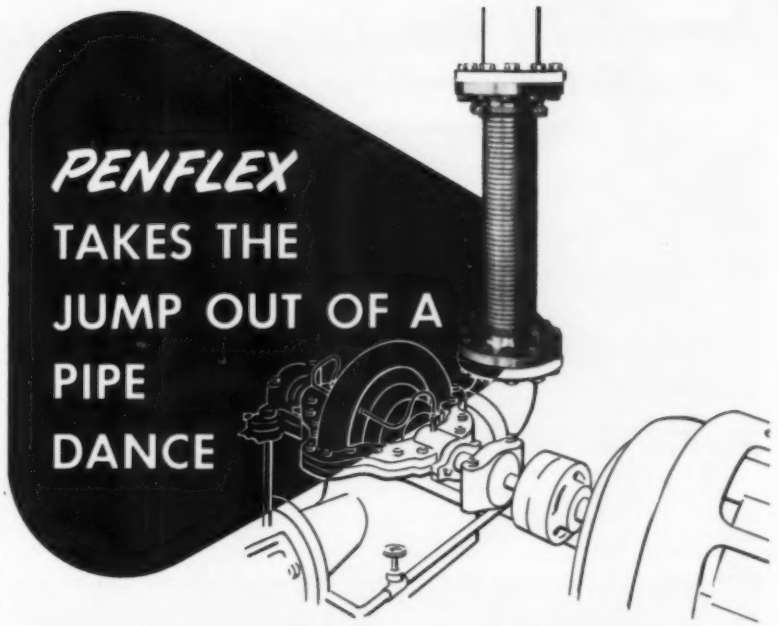
Overhead units feature a coiled alloy element sealed in a tube made of "Vycor" silica glass, frosted inside and out. This material transmits more than 90 percent of the infrared waves. Suited for both indoor and outdoor use and exposure to rain and snow. Available in 1000, 1500, 2000, 2500, and 3000 w models, for 120, 208, 240, and 277 v operation. — *Berko Electric Mfg. Corp., Dept. VOH, 212-40 Jamaica Ave., Queens Village, N.Y.*

Thermocouples Enclosed In Stainless Steel Tips

Used in recording temperatures for pre-heating and stress relieving in field and shop welding. Made with matched and graded 14 gage wire, units are processed and tested for accuracy to 1900 F. Stainless steel tips enclose thermocouple heads. Insulation with glass sleeving for induction heating and ceramic spline beads for resistance heating. — *Electric Arc, Inc., 152 Jelliff Ave., Newark 8, N.J.*

Plastic Template For Piping Drawings

For making isometric pipe drawings. Made of clear plastic with rounded corners, template has cutouts for most common fitting symbols. — *Wally Verrett, Dept. 120, P.O. Box 3144, Port Arthur, Tex.*



DAMPENS VIBRATION . . . CORRECTS MISALIGNMENT . . . ABSORBS EXPANSION

When the lines get the jitters, the units get the breaks throughout the system. That's where a Penflex flexible connector should be installed.

These "Job-Proved" flexible connectors have been developed to soak-up the vibration in the refrigeration, heating and air conditioning lines in commercial and industrial installations. They correct the misalignment of pipes caused by pump or compressor motion and prevent pipe cracks and system breakdowns. As the lines become hotter or colder the Penflex connector expands or contracts . . . always assures a tight system with peak operating efficiency.

Flexible connectors, vibration dampeners, flexible lines have all been developed . . . thoroughly pre-tested by Penflex . . . and "job-proved" throughout the industry to be unsurpassed for trouble-free operating efficiency.

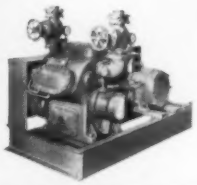
If you want your system to operate at its very best specify Penflex for flexibility at all temperature zones. Write for complete data to Pennsylvania Flexible Metallic Tubing Co., Paoli, Pa.

Penflex

TIGHT AS A PIPE . . . BUT FLEXIBLE

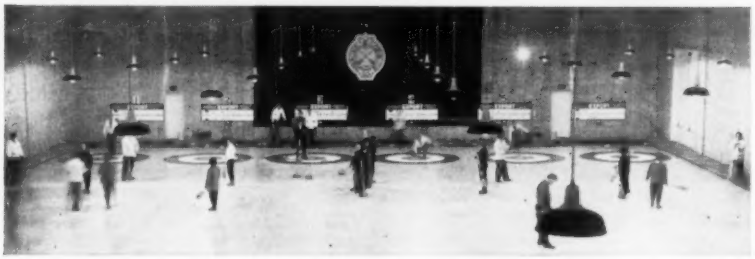
Summer Cooling... Winter Curling and Skating - all with ONE refrigeration system

Main entrance to Prudhomme's Garden Centre Motor Hotel in Vineland, Ontario. This exciting summer and winter playground spot uses Vilter refrigeration to good advantage.



Two 6-cyl. Vilter VMC belt-driven compressors provide refrigeration at Prudhomme's for summer air conditioning and winter curling.

The Garden Centre Theatre becomes a regulation six-sheet curling rink during the winter months. The Vilter system is designed to produce ideal curling ice at the lowest possible power cost.



Year 'round use of your refrigeration capacity is sound business and enables maximum profit to be realized from your investment.

An excellent example of the year-'round utilization of refrigeration is Prudhomme's Garden Centre Motor Hotel in Vineland, Ontario, along the Queen Elizabeth Way. At this famous motel, recreation center and convention headquarters, Vilter refrigeration plays an important role in keeping guests happy.

During the summer months, refrigeration is required to air condition the 180-room motel, one of Canada's largest, and an 1100-seat summer stock theatre which draws large crowds to see outstanding stock productions of Broadway plays. In winter months, the same equipment builds ice surfaces for a 90′ x 180′ outdoor ice skating rink and a regulation six-sheet curling rink. The summer stock theatre building is used to house the curling rink with either a seating structure installed or plastic piping laid for the curling rink, depending upon the season.

Vilter equipment installed at Prudhomme's includes two 6-cylinder VMC compressors and a 24″ x 20′ shell and tube condenser.

Vilter has had many years of experience in recommending and building refrigeration systems for air conditioning and ice rinks. This know-how, plus the use of dependable economical-to-operate Vilter equipment, can also mean a satisfying installation for you. Why not see your nearest Vilter representative today?

Sold and Installed by VILTER DISTRIBUTOR
J. L. Wilson and Sons, Limited, Toronto, Ontario, Canada

Vilter® refrigeration air conditioning

The Vilter Manufacturing Company
Milwaukee 7, Wisconsin
Air Units • Ammonia and Freon Compressors • Booster Compressors Baudelot Coolers • Water and Brine Coolers • Blast Freezers Evaporative and Shell and Tube Condensers • Pipe Coils Valves and Fittings • Pakice and Polarflake Ice machines.

Write for helpful bulletins to The Vilter Manufacturing Company, Dept. F-614 2217 South First Street Milwaukee 7, Wisconsin

EQUIPMENT DEVELOPMENTS
Continued

A-C, D-C Gas Welders Operate From Single-Phase Power

Can be used for manual, automatic, tungsten inert-gas, inert-gas spot, or gas-shielded-arc consumable welding. Two models: "ADI-2641" rated 200 amp with a welding range of 1 to 300 amp a-c, or 1 to 350 amp d-c; "ADI-3641" rated 300 amp with a welding range of 1 to 375 amp a-c, or 1 to 410 amp d-c. Both operate from single-phase 230/460 a-c power. — *Hobart Brothers Co., Hobart Square, Troy, O.*

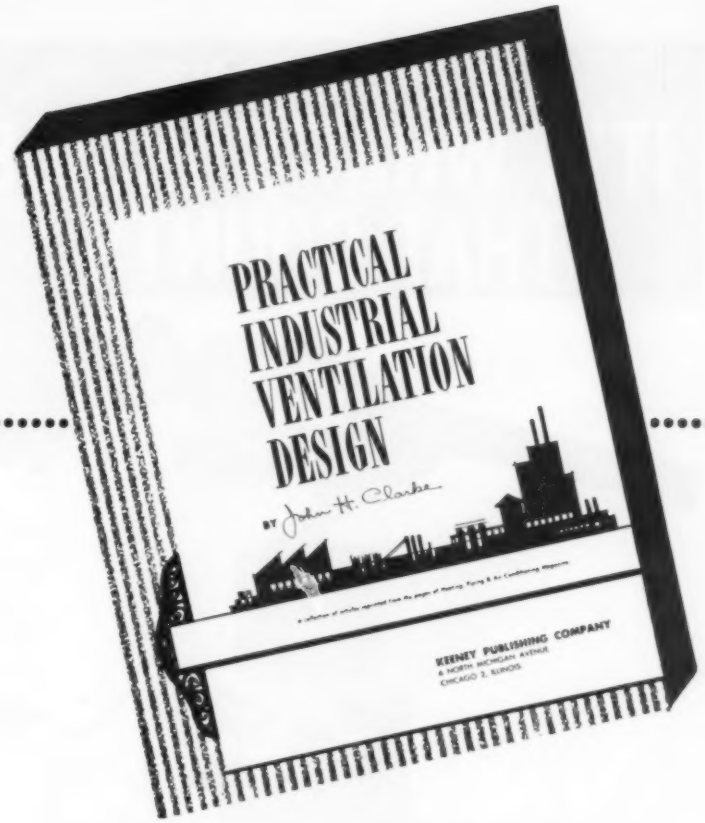
Pneumatic Nibblers For Heavy Duty Cutting

For cutting ¼ in. steel plate, 8 gage stainless steel, and 5/16 in. aluminum. Cuts any size radius from 8 in. with a speed of from 40 to 45 ipm. Unit weighs 18½ lb and has a cutting principle that forces chips down and away from operator. — *Fenway Machine Co., Inc., 1910 N. Marshall St., Philadelphia 22.*

Portable Gas Heater Has 100,000 Btu Per Hr Capacity

For producing large amounts of radiant heat, operating on all gases. Available in 50,000 and 100,000 Btu per hr models, 36 in. high, 18 in. in diameter, and weighs 50 lb. Shut-off valve automatically cuts off gas at the burner if pilot flame goes out. — *Space-Ray Corp., P.O. Box 3485, Charlotte, N.C.*

NOW AVAILABLE IN HANDBOOK FORM!



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BY JOHN H. CLARKE

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These articles were written exclusively for HPAC by John H. Clarke, one of the country's foremost authorities on industrial ventilation. In them he offers readers a wealth of ideas *not available anywhere else* on subjects like these:

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3. How to design for heat recovery.
4. How to design makeup supply air systems.

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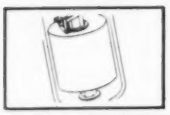
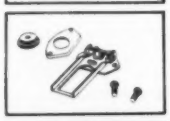
in any steam trap...
IT'S WHAT'S INSIDE THAT COUNTS

Inside
SUPER-SILVERTOPS

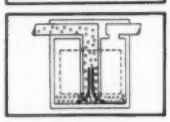


GUIDED BUCKET—Inverted bucket is guided on patented center tube. Results in perfect alignment—no damage to internal parts. Guarantees positive leakproof seating of valve.

NO RESTRICTED PASSAGES—Passages are short, liberal size, clean and smooth bore. Cannot clog with foreign matter. Assure full operating efficiency for trap life.



ANDERLOY VALVE AND SEAT—Eliminates erosive effect of steam. Held in place with clamp and stainless steel screws. Easily removed.



REVERSE FLOW—Bucket remains stationary and the valve open, even during heavy load periods. Stirs up sediment—keeps trap clean.

QUALITY ENGINEERING—The above features of Super-Silvertop Steam Traps are indicative of the outstanding engineering principles employed in the manufacture of all Anderson Steam Specialty products.

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SUPER SILVERTOPS STEAM TRAPS
BY THE MANUFACTURERS OF Hi-eF PURIFIERS

THE V. D. ANDERSON COMPANY
Division of International Basic Economy Corporation
1949 West 96th Street • Cleveland 2, Ohio

EQUIPMENT DEVELOPMENTS
Continued

Back Pressure Regulator Has Capacity of 50,000 Lb Steam

Sliding gate units with capacities of 50,000 lb of steam per hr or 2500 gpm of water. Entire system or main valve and pilot only may be purchased. System suitable for pressures to 250 psi wsp and temperatures to 500 F. Bulletin SRBc 62-60 sent on request. — *OPW-Jordan Corp.*, 6013 *Wiehe Rd.*, *Cincinnati* 13.

Portable Heaters Available For 400,000 Btu Per Hr

Weighs 35 lb and circulates 50,000 to 75,000 Btu of forced air per hr. "B-75" uses kerosene or No. 1 fuel, operating on 115 v a-c current. Automatic control allows combustion chamber to cool before fan is cut off. Larger models producing 125,000, 320,000, and 400,000 Btu per hr available. — *Master Vibrator Co.*, 1752 *Stanley Ave.*, *Dayton* 1, *O.*

Relief Valve for Handling Corrosive Fluids

With a polyvinyl chloride body for corrosive fluid handling applications. Resists corrosive attacts by acids, alkalis, salt solution, alcohol, and other chemicals. Sizes to 2 in., for pressures to 120 psi, and temperatures to approximately 160 F. Reduced pressure ranges are 5-15, 10-80, and 50-120 psi. Springloaded, diaphragm-actuated, single seat unit modulates in response to upstream pressure. — *Atlas Valve Co.*, 280 *South St.*, *Newark* 5, *N.J.*

EQUIPMENT DEVELOPMENTS
Continued

Temperature Controller Serves 10 Processes

Provides two-position control for up to 10 separate processes. Can also be used as a single point controller, a five-point, three position controller, and a manual-balance indicator. Unit combines a null-balance potentiometer measuring circuit with an electronic control system. Accuracy is 0.5 percent of range. Calibrated range scales available for all standard thermocouple materials. Standardization accomplished by means of a constant voltage supply unit. — *Thermo Electric Co., Inc., Saddle Brook, N.J.*

Portable Pneumatic Nibbler For Contour Cutting

With a capacity of 0.064 in. steel at a rate of 6 fpm. Unit weighs 3 lb and has a turning radius of 1 in. A cut 7/32 in. wide, attainable without burring or deforming sheet; nibbler will cut to within 3/8 in. of a template. — *Newage Industries, Inc., 222 Old York Rd., Jenkintown, Pa.*

Clamp Couplings for Tubing, Duct Hanging, Insulation

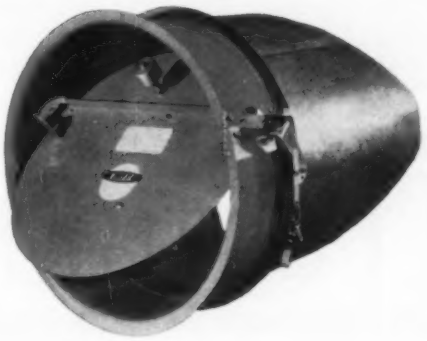
Available in various shapes, couplings made from a solid flat band, ½ in. wide, of cold-rolled strip steel, plated for corrosion protection. Units provide a leakproof seal. Catalog OEM-1060 sent on request. — *Wittek Mfg. Co., 4305 W. 24th Place, Chicago 23.*

to correct

DRAFT SHORTAGES

in

GAS BOILERS



install double-acting

field

DRAFT CONTROLS

Replace your draft diverters with modern Field Draft Controls. A Field makes the draft assistance of the chimney available to the boiler for abundant draft at all firing rates, precisely controlled to the optimum twelve-to-one air-to-gas ratio recommended for clean, bright, efficient gas combustion. For 5″ through 34″ flues. Write for specification data.

Specify Field Draft Controls for gas, gas-oil, oil or coal, for boilers, furnaces, incinerators, with natural, forced or induced draft, 5″ through 34″ flues.

FIELD CONTROL DIVISION

Conco Engineering Works, Inc., Mendota, Illinois

AFFILIATES: Spartan Tool Division — Powered Sewer Cleaning Equipment
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CENTRIFUGAL

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USE AURORA CENTRI-PAC PUMPS

CAPACITIES TO 400 GPM / HEADS TO 150 FEET

NOW AVAILABLE IN 11 PACKAGED SIZES

AIR CONDITIONING EQUIPMENT / CIRCULATING SERVICES / GENERAL SERVICES

- LOWER IN COST . . . made possible by standardization of most popular sizes packaged and stocked for immediate off-the-shelf shipment.
- EXTREMELY COMPACT . . . close-coupled design saves valuable space and is more easily installed.
- HIGHLY EFFICIENT . . . low horsepower requirement means less initial cost and lower operating expense.
- EASILY MAINTAINED . . . pump can be completely disassembled for inspection and repair without disturbing the piping.
- QUALITY CONSTRUCTION . . . bronze fitted, mechanical seals, drip-proof NEMA rated motor with stainless steel shaft and built-in overload protection, and cast bronze impeller keyed and locked in position.
- SMOOTH, QUIET OPERATION . . . low NPSH meets critical suction conditions.

You may also select from a complete line of horizontal or vertical mounted pumps and flexible-coupled pedestal-mounted pumps engineered to your specific requirements.

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EQUIPMENT DEVELOPMENTS

Continued

Fan-Coil Unit Permits Counterflow Operation

For small commercial applications. Chilled-hot water unit with reversible and movable components permitting counterflow operation from either side. Model "FCF-42-96" rated at 42,000 Btu per hr cooling and 96,000 Btu per hr heating. Fan section can be rotated for horizontal or up or down vertical air flow. — *Arkla Air Conditioning Corp., 812 Main St., Little Rock, Ark.*

Globe, Check Valves For Water, Oil, Gas

For working pressures of 2500 psi cold water, oil, or gas. Bronze units have 45 deg seat (flat to flat). Globe valves furnished with bolted bonnets with "O" ring gasket and handwheels in 1½ and 2 in. sizes. — *Crane Co., 155 N. Wacker Dr., Chicago 6.*

Pipe Line Strainer Has "Backwash" Cleaning Feature

Unit has reverse flow of "backwash" fluid that literally rinses it free of all foreign matter at the turn of a valve. Debris-laden waste is discharged directly into existing drainage system. Available in single or double gate or plug type models, accommodating full range of pipe line sizes. — *Fluid Control Div., Zurn Industries, Inc., Erie, Pa.*

EQUIPMENT DEVELOPMENTS
Continued

Control Valves for 1/4 In. OD Tube

With "Swagelok" connections for 1/4 in. OD tube. Fingertip control for brass or Type 316 stainless steel units. Male pipe connections also supplied. Available in straight and angle patterns, and has a 3000 psi pressure rating with a 0.172 orifice diameter. Micro-regulating or non-regulating 316 stainless steel stems. — *Whitey Research Tool Co., 5525 Marshall St., Oakland 8, Calif.*

Pipe Thermometer Counteracts Heat Loss Error

For all pipe up to 3½ in. diameter. Clips to steam, water, refrigeration, gas, and other pipes by means of twin spiral clips. Units precalibrated to counteract error through heat losses of radiation or convection. Dials are 2½ in. in diameter with graduated 2 F divisions. Two ranges: 32 to 320 F. and −14 to 134 F. Literature sent on request. — *Abrax Instrument Corp., 179-15 Jamaica Ave., Jamaica 32, N.Y.*

T-Fitting for Hydraulic, Pneumatic, Process Lines

For applying pressure gages or other instruments to hydraulic, pneumatic, and process lines. Available in aluminum, brass, monel, steel, and stainless steel. Seals against pressure, temperature, vibration, surge, and acts as a vibration dampener. Offered in size range from 1/16 through 2 in. diameters with pipe thread. *C. B. Crawford Co., 16606 Waterloo Rd., Cleveland 10, O.*

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When the job's got to be right . . . at the right price . . . remember Hydrotherm!
Gas heat costs less than oil heat in big jobs (to 3,600,000 BTU/Hr) when you install Hydrotherm's MULTI TEMP hydronic system.
Sequence-fired combustion chambers permit automatic input modulation in accordance with load requirements — no short cycling — no override — built-in standby protection. Factory assembled . . . fits through a 2 ft. 6 in. door.
Easy to install, all cast iron, and guaranteed for 25 years . . . you can't miss with Hydrotherm.
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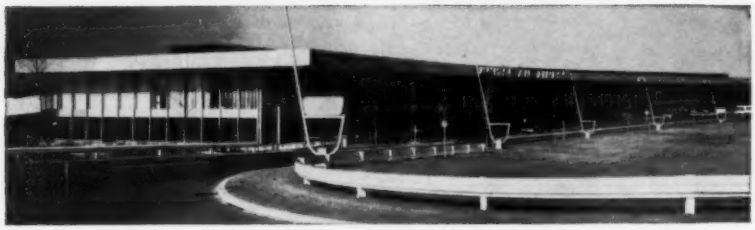
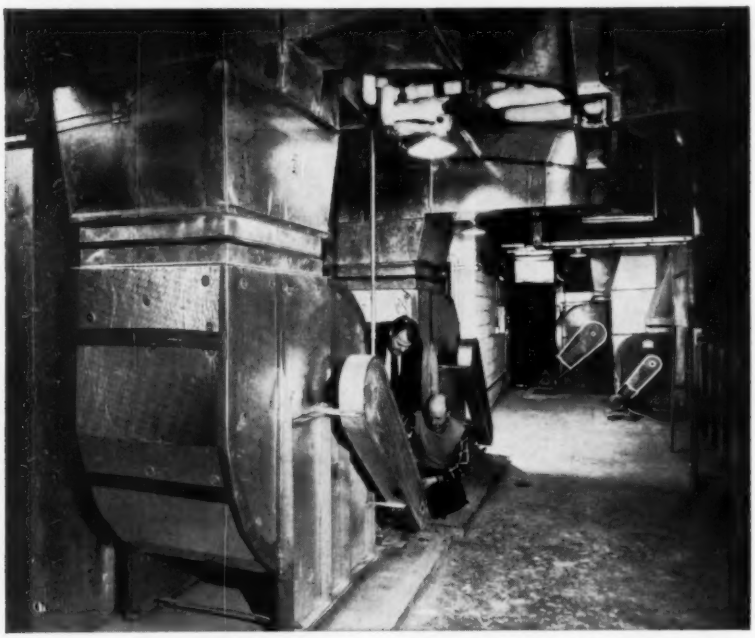
ANOTHER PEERLESS ELECTRIC SPECIAL BLOWER APPLICATION



United Air Lines Terminal Building, Idlewild Airport. Architects: Skidmore, Owings & Merrill. Consulting Engineers: Syska & Hennessy, Inc. General Contractors: Humphreys & Harding. Mechanical Contractors: A. D. Walker & Co., Inc.



Four of the 52 Peerless Electric Blowers. Shown are Philip M. Larkin (left), Senior Project Engineer, and Warren Dorrman (right), Project Supt. of A. D. Walker & Co., Inc.

"COMPLEX AIR HANDLING PROBLEMS MET BY PEERLESS ELECTRIC BLOWERS"

—Philip M. Larkin, Senior Project Engineer

Excessive heat transmission from an 800′ long, 20′ high glass front makes difficult the design target of 78° F maximum summer temperature with 50% relative humidity. In winter the need is for 65-70° F with humidity low enough to avoid condensation. Variations cannot exceed a minus 2% in temperature or plus 5% humidity. And the complete system must serve 45 different areas of the building, including the kitchen.

Tight space conditions and aircraft fumes added to the installation problem. The solution: 52 Peerless Electric Fans to supply and exhaust the 175,000 square foot building area. Peerless Engineers worked closely to make possible the necessarily delicate air balance.

No matter how complex your next job, let Peerless Electric engineer your air moving needs. Write: *Peerless Electric Division, H. K. Porter* Company, Inc., W. Market Street, Warren, Ohio.

PEERLESS ELECTRIC DIVISION PORTER H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

EQUIPMENT DEVELOPMENTS

Continued

Pipe Welder Butt Welds Without Backing Ring

For automatic roll welding of pipe, will butt weld without use of backing ring. Includes a wire feeder coupled to a constant voltage motor generator welder. Small filler wire is fed to a fixed welding torch for flat position or roll welding, or to a hand torch for semiautomatic applications. Unit's range is from 16 to 20 v, 30 to 150 amp, d-c reverse polarity. — *Hobart Brothers Co., Hobart Sq., Troy, O.*

Portable Pump Creates Heads to 55 Ft

Canned, self-priming unit combines pump and motor in one enclosure. Handles up to 11 gpm and temperatures to 180 F. Creates heads to 55 ft and suction lifts to 15 ft. Available in cast iron, bronze, or stainless steel. — *The Corley Co., Inc., 685 Myrtle Ave., Bounton, N.J.*

Radiation Meter Operates On Two Flashlight Batteries

For measuring alpha, beta, gamma, radiation. Completely portable, operating on 2 standard flashlight batteries. Unit has a 275 deg 4¼ in. long scale and will operate in temperatures from −22 to 125 F with an absolute accuracy of 15 percent. A gamma sensitive geiger tube supplied with meter. Two ranges can be selected using toggle switch: 0-10 and 0-200 mr/h. — *Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.*

you'll want to know

(Continued from page 46)

Trinity University Selects Central Heating, Cooling

A CENTRAL heating and cooling plant now under construction at Trinity University in San Antonio, Tex., will pipe hot and chilled water to several campus buildings for year around air conditioning.

The plant will be completed by mid-1961, and will be the first in the San Antonio area to use an absorption machine.

University officials decided on a central plant to supply heating and cooling because "it offers economy of operation and low first costs over a long amortization period." It is also flexible in meeting changing loads, according to the University.

The George Storch Memorial Library and Preston Northrup Hall, a classroom and administration building, will be the first buildings served by the new plant. Approximately 50 percent of the 375 ton capacity of the initial absorption unit will be used in these areas.

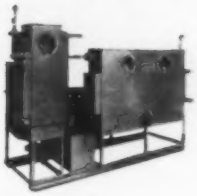
Space is provided in the utility center for the addition of another heat-activated unit to serve future buildings. The system can be expanded to eventually total more than 1000 tons cooling capacity from this central plant.

Natural gas will be used by the boiler to supply high temperature hot water used by the absorption machine for cooling. Gas will also be used by a hot water generator to supply hot water for heating.

Selection of equipment was made by R. S. Purvis, director of physical plant at Trinity. Martin Staley was the consulting engineer, and O'Neil Ford Associates were the architects.

KATHABAR® SYSTEMS

Give these advantages to specifying engineers:



STERILE AIR

Now you can design spaces to maintain air sterility as scientifically as temperature and humidity. Only Kathabar enables you to deliver air at 5 micro-organisms per 10 cu. ft. or less, continuously.

FROST-FREE COOLING

Get continuous air supply at dry bulbs and dew points way down to –90 F. No freeze-ups... no fluctuating efficiency... no defrosting shutdowns... no duplicate sets of coils. Cool better; fewer tons. Proved in candy cooling... photo film chilling... brewing... chemical processing... environmental testing... many other applications.

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A Division of Midland-Ross Corporation

Send facts on Kathabar systems for following application:

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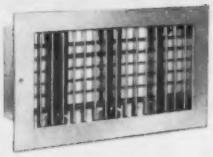
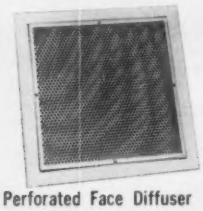
Surface

59-2E

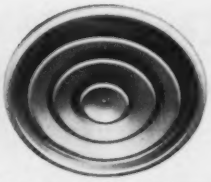


Sidewall Registers
with Opposed Blade Damper

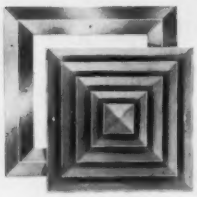
Flush Mount Ceiling Diffuser



Perforated Face Diffuser



Recessed Ceiling Diffuser



Pattern Diffuser

Linear Extruded Aluminum Grille

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Booths
310-314 at
The Heating &
Air Conditioning
exposition

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for the
KRUEGER
Design-Air
Display

SEE

the most complete line
of
Registers and Grilles,
Diffusers and Dampers
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Walter McCarty Heads RACCA National

THE NATIONAL PRESIDENT of the Refrigeration and Air Conditioning Contractors Association for 1961-62 is Walter McCarty, associated with the air conditioning contracting firm of McCarty Bros. Equipment Corp., River Forest, Ill. He was unanimously elected by the delegates at the concluded RACCA national convention held in Miami.

New officers elected to serve with Mr. McCarty are: Don Kissel, Los Angeles, 1st vice president; Brooks Reeder, Detroit, 2nd vice president; Robert Lafferty, Miami, recording secretary; Harvey Hottel, Washington, D. C., treasurer; and Joseph Marchase, Pittsburgh, sergeant-at-arms.

MAPPA Elects Five At Annual Meeting

NEW PRESIDENT of the Midwest Air Pollution Prevention Association, Inc. is Daniel A. Sullivan, consultant for the Armour Research Foundation. His election was one of five made at the group's annual meeting held last December in Chicago.

Lewis Evans, Chicago & Indiana Railroad Co., was re-elected first vice president. Elected second vice president was Dr. George S. Gordon, ARF director of chemical research. Douglas R. Fuller, Northern Trust Co., was re-elected treasurer of MAPPA; and Dusan Ljubenko, administrative supervisor, ARF chemistry research division, was elected secretary.

NACE Elects Officers For 1961-62

THE NEW PRESIDENT of the National Association of Corrosion Engineers is E. C. Greco, senior research chemist for the United Gas Corp., Shreveport, La. He will be installed March 17, the last day of the Association's 17th Annual Conference and 1961 Corrosion Show at Buffalo, N.Y., along with the other officers and directors elected. The officers will serve for one year.

Rolland McFarland, secretary and technical director of Hills-McCanna Co., Chicago, has been elected vice president. Re-elected treasurer was C. G. Gribble, Jr., district manager for the Metal Goods Corp., Houston.

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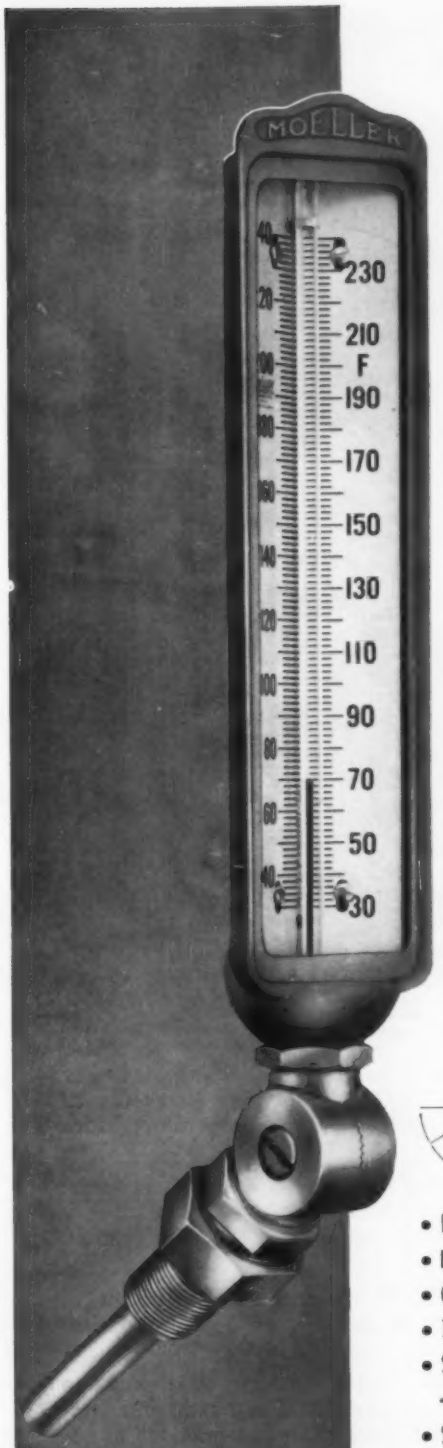

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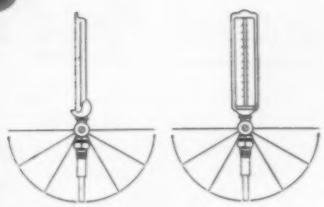

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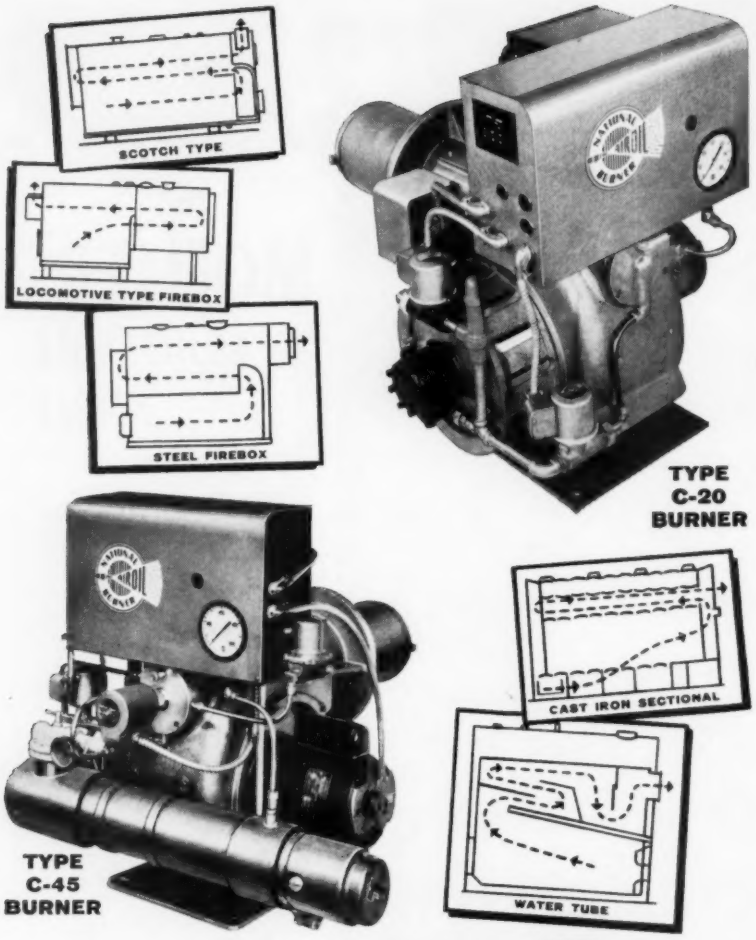

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RECENT TRADE LITERATURE . . .

▸ *AIR CONDITIONING SCHOOLS*—20 page booklet discusses the economic and educational advantages of air conditioned schools. Gives four case histories, with one being compared to a conventional school without air conditioning. *Commercial Div. of Minneapolis-Honeywell Regulator Co.* 2747 *S. Fourth Ave., Minneapolis* 8.

▸ *AIR DIFFUSER COMBINES LIGHT AND AIR*—24 page booklet gives selection and application data for dual purpose units. Two basic sizes, 12 × 48 in. and 24 × 48 in. Features variety of lighting enclosures; louvers, plastic, glass; and supply or return models. A sound-slide film available also for showing to groups. *Barber-Colman Co., Dept. B,* 1101 *Rock St., Rockford, Ill., or Day-Brite Lighting, Inc.,* 6260 *N. Broadway, St. Louis* 15.

▸ *AIR FILTER*—eight page Bulletin B-1400-8 describes four models of roll-filter unit: automatic drive or manual operation for advancing media across face of filter. Technical data includes dimensional drawings, capactiy tables, and selection instructions. *Farr Co., P.O. Box* 90187, *Airport Station, Los Angeles* 45.

▸ *AIR SAMPLING TECHNIQUES*—three page manual No. 2 describes methods of measuring dust and gases in air. Reviews several techniques and gives directions for testing. *Gelman Instrument Co.,* 106 *N. Main St., Chelsea, Mich.*

▸ *BALL VALVE*—four page Bulletin DH-38 describes forged naval bronze unit for water, oil, and gas service available in sizes from ½ to 2 in. inclusive. Includes a cross-section illustration detailing the con-

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struction of the valve keyed to a material and dimension specifications table. *R-P & C Valve Div., American Chain & Cable Co., Inc., Reading, Pa.*

▸ *BOILER LEASING*—literature explains firm's two plans to lease automatic packaged boilers or sell them on installment payments. *Continental Boiler Div., Boiler Engineering & Supply Co., Inc., Phoenixville, Pa.*

▸ *CENTRIFUGAL PUMPS*—four page bulletin, Form 70287 describes units with a 1750 rpm operating speed. Output from 15 to 500 gpm with heads to 110 ft. Can be mounted in any position provided motor is kept higher than pump. *Ingersoll Rand Co., 11 Broadway, New York 4.*

▸ *CONDENSATE RETURN PUMPS*—four page Bulletin 21-C describes units with capacities of from 500 to 10,000 sq ft edr with discharge pressures from 20 to 40 psi. Operating speed is 3500 rpm. Four page Bulletin 19-B describes units with capacities of from 2000 to 50,000 sq ft edr with discharge pressures up to 75 psi. Both 1750 and 3500 rpm operating speeds available. *Skidmore Corp., P.O. Box 309, St. Joseph, Mich.*

▸ *CONTROL SYSTEM*—12 page bulletin SF-755-A describes basic control instrument, as well as various means of measurement which can be employed with it. Information also provided on "FultroMatic" system with reset. *Fulton Sylphon Div., Robertshaw-Fulton Controls Co., P.O. Box 400, Knoxville 1, Tenn.*

▸ *CONTROL SYSTEM*—12 page Bulletin GEA-7080 describes custom-built system for central air conditioning and other functions such as motor starting and control, power switching,

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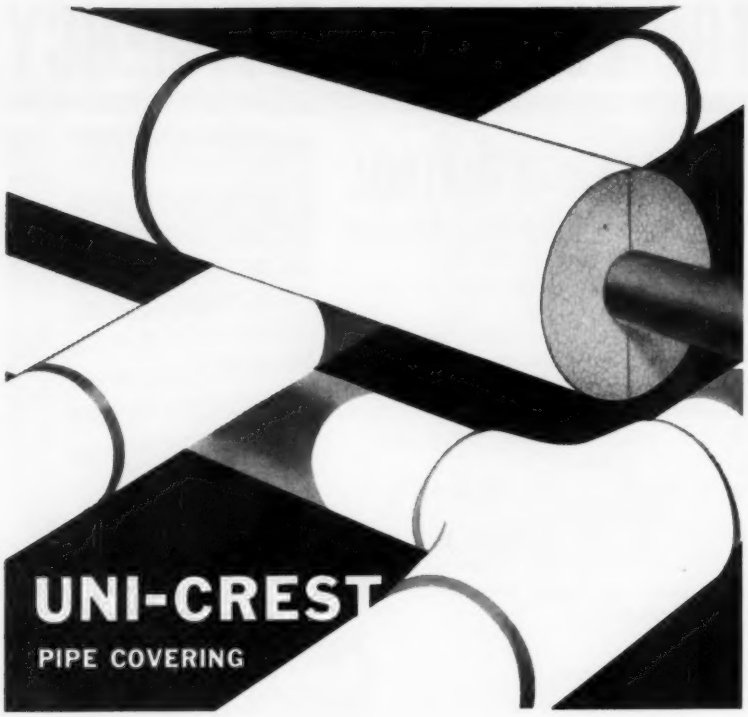

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circuit relaying and sequencing, motoring, and process instrumentation. "Cabinetrol" systems can be built for power concentrations up to 4000 amp. *General Electric Co., Schenectady 5, N.Y.*

▸ *DUCT SILENCERS*—catalog describes packaged "Quite-Duct" units and lists performance of over 44 unit sizes and 90 multiple unit sizes by airflow (from 185 to 372,000 cfm) and by pressure drop (from 0.1 to 1.50 in. water gage). *Industrial Acoustics Co., Inc., 341 Jackson Ave., New York 54.*

▸ *ELECTRIC HEATING*—24 page supplement CS-600 contains specifications and product illustrations of electric heater bands, air heating elements, blower-type heaters, immersion units, engine heaters, mineral insulated heating cable, special radiant heaters for process and comfort heating, controls, and other equipment and elements. *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8.*

▸ *ELECTRIC MOTORS*—12 page catalog describes units rated from ½ to 10,000 hp. Data given on a-c induction motors, either low or high slip; constant speed synchronous motors, in horizontal or vertical construction; and d-c motors. Selection and specification data also included. *Fairbanks, Morse & Co., Electrical Div., 303 N. Henderson, Freeport, Ill.*

▸ *EVAPORATIVE CONDENSERS*—14 page Bulletin 143 gives general theory and design of condensers along with the basic refrigeration cycle. Selection information for summer and winter operations, capacity control, typical piping arrangements, and system purging explained. *Baltimore Aircoil Co., Inc., P.O. Box 7322, Baltimore 27.*

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▸ *EXHAUST HEADS*—for removing impurities from exhaust steam being discharged to the atmosphere, described in Form AD-2438. Units employ principle of centrifugal force to remove liquid and solid from steam vapor. Includes illustrations, dimensions, weights, and capacities. *Crane Co.*, 4100 *S. Kedzie Ave., Chicago* 32.

▸ *FAN-COIL UNITS*—four page folder describes five models available in three styles for heating and cooling small stores, offices, schools, and similar structures. Selection data, specifications, and other technical data given in tables. *Thermal Engineering Corp., P.O. Box* 13254, *Houston* 19.

▸ *FIBRE DUCT*—four page bulletin describes "Sonoairduct" for slab perimeter heating, cooling, or combination heating and cooling systems. Installation instructions given along with tables and charts. *Sonoco Products Co., Construction Products Div., Hartsville, S.C.*

▸ *FILTER ASSEMBLY*—four page Bulletin No. 600 describes in-line filter assembly for application wherever caustic and/or corrosive liquids or gases are handled. Engineering drawings and specification data given with application information. *Dumont Engineering Corp.*, 1401 *Freeman Ave., Long Beach, Calif.*

▸ *FLAT OVAL DUCT*—bulletin describes duct and fittings for high-pressure, high-velocity air systems. Includes sizes, and gives data on pressure-loss, reinforcement to minimize amplitude of wall vibration, and static pressure deflection. *United Sheet Metal Co., Inc.*, 540 *S. Drexel Ave., Columbus* 9, *O.*

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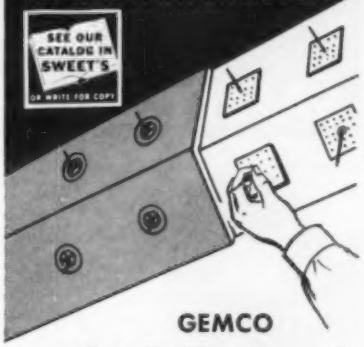

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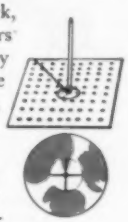

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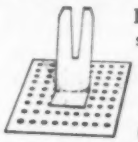

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▸ *FLEXIBLE BALL JOINTS*—four page Catalog 250 covers units in sizes from ¼ through 16 in. with threaded, flanged, or welding end connections and joints for temperatures up to 1200 F and pressures to 4500 psi. Application and technical data included. *Barco Mfg. Co.*, 501 *Hough St., Barrington, Ill.*

▸ *FLEXIBLE HOSE AND DUCT*—12 page Bulletin 605 describes units for moving air, dust, fumes, and materials by means of pressure, suction, or gravity. Selection and installation data, and accessory information included. *The Flexaust Co., Div. of Callahan Mining Corp.*, 100 *Park Ave., New York* 17.

▸ *FLEXIBLE TUBING*—for ventilation, fume removal, and materials handling systems, described in a brochure, "The Facts About Flexflyte." Seven types of product, their characteristics, construction, and standard sizes included. *Flexible Tubing Corp., Guilford* 2, *Conn.*

▸ *GAS AIR CONDITIONING SYSTEMS*—brochures, specification sheets, and other explanatory literature for natural or LP gas powered air conditioning or combination heating cooling systems available. *Vector Engineering Contractors, Inc.*, 2321 *Forest Lane, Garland, Tex.*

▸ *GATE AND GLOBE VALVES*—six page bulletin describes cast steel units for high pressure, high temperature applications. Lists dimensions and weights for 600, 900, 1500, and 2500 lb ASA ratings for all units from 2 through 18 in. Cross-sectional and sideview drawings, complete material specifications list, and an identification of a disassembled valve given. *Walworth Co.*, 750 *Third Ave., New York* 17.

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▸ *HEAT LOSS COMPUTERS FOR ELECTRIC HEAT*—heat loss of a room heated completely or partially by electricity computed on short working charts, Form E19. *Spartan Electric Radiator Corp.*, 52-55 74*th St.*, *Maspeth* 78, *N.Y.*

▸ *HERMETIC COMPRESSORS*—two four page brochures give specifications and performance data of four and six-cylinder motor-compressors. Form No. 6001 describes four-cylinder 7½, 10, and 20 hp models; Form No. 6006 describes six-cylinder 10, 20, and 30 hp models. Tables give data on capacity, power consumption, motor current, and name plate rating. *Copeland Refrigeration Corp.*, *Sidney*, *O.*

▸ *INDUSTRIAL WATER COOLERS*—four page Bulletin 108 gives selection data and specifications for centrifugal-fan blow-through units; centrifugal-fan draw-through units; and tubeaxial-fan blow-through units. *Baltimore Aircoil Co., Inc.*, *P.O. Box* 7322, *Baltimore* 27.

▸ *LOW VOLTAGE DISTRIBUTION EQUIPMENT*—92 page catalog, the "Buy Log," No. GEC-1100C covers heavy duty safety switches, circuit breakers, motor control centers, and power distribution centers. Ratings, weights, dimensions, and general application information given along with selection data. *Distribution Unit, General Electric Co., Plainville, Conn.*

▸ *MEMBRANE FILTER*—three page Manual No. 5, "Radiochemical Applications of the Membrane Filter" includes a bibliography of 25 references. The membrane filter is a microporous plastic with uniform micron sized holes. It can be used to filter all radioactive particles from fluid and gas streams. *Gelman Instrument Co.*, 106 *N. Main St.*, *Chelsea*, *Mich.*

▸ *METALLURGICAL RESEARCH*—eight page brochure describes electronic system of searching metallurgical and related literature for specific information. System includes information on anything published in the preceding two weeks. *American Society for Metals*, *Metals Park*, *Novelty*, *O.*

▸ *OIL BURNER INSTALLATION SERIES*—four page bulletin and a diagram give specifications for an oil burner installation in a government building. Includes information on boilers, fuel burning equipment, controls, combustion tests, service responsibilities, and other data. *Ray Burner Co.*, 1301 *San Jose Ave.*, *San Francisco* 12.

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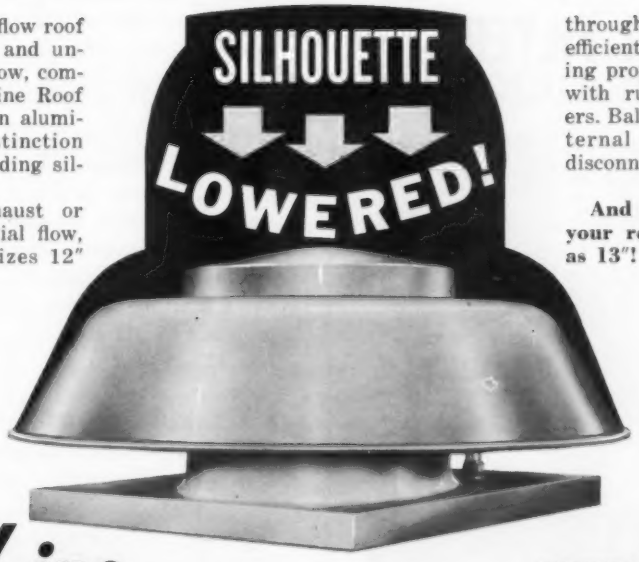

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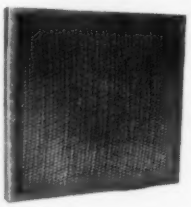

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Has a specially designed high velocity Viro-Crimp Filter media. Hemmed edges provide a safety feature. Operates efficiently at 300 to 600 fpm. Available in 2" and 4" thickness. Bulletin No. W-803.

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RECENT TRADE LITERATURE

Continued

▸ *PIPE CONDUIT BENDING DEGREE INDICATOR*—eight page Bulletin No. E-301 gives instructions, charts, and other data for using firm's "No. 1807 model." Features method for laying out and bending pipe and conduit ½ to 6 in. in diameter. Two pages of tables provide data required for making 10 to 84 in. radius bends. *Greenlee Tool Co.*, 2136 12*th St., Rockford, Ill.*

▸ *PLASTICS WELDER*—four page Manual 60-2 contains operating and maintenance instructions for welding thermoplastics such as polyethylene, polypropylene, and rigid and plasticized PVC. Data given on preparation of material, tacking operation, hand-welding, and medium and high-speed welding with round rod and plasticized strip. *Kamlar Products Co.*, 932*R Washington St., Norwood, Mass.*

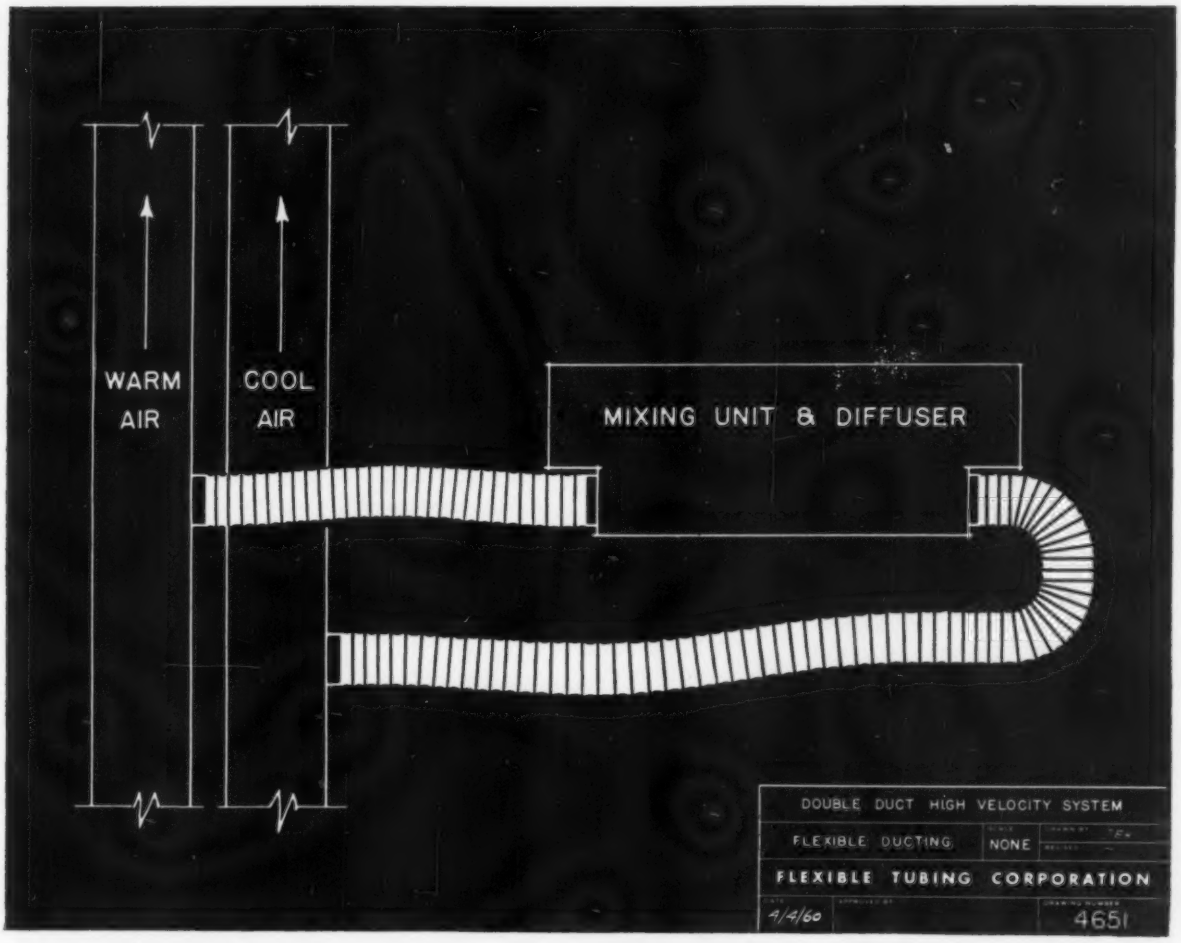
▸ *PREPARATION OF A CONSULTING ENGINEER'S FIRM BROCHURE*—24 page booklet available to members of the Consulting Engineers Council as a "blueprint" to follow in compiling individual firm brochures. Contains excerpts and ideas from brochures published by consulting engineering firms. *Consulting Engineers Council*, 326 *Reisch Bldg., Springfield, Ill.*

▸ *PRESSURE PIPE*—124 page installation guide for "Transite" pressure pipe. Covers handling and installation from loading and unloading through all necessary operations such as assembly of pipe and couplings, cutting and machining, design of thrust blocks, service connections, backfilling and tamping, testing, and other operations. *Johns-Manville*, 22 *E. 40th St., New York* 16.

▸ *PROTECTIVE COATING*—four page bulletin "Pioneer No. 1008 Vapor Seal" describes mastic protective coating. Product is a blend of asphalts, petroleum resins, plasticizers, asbestos, mica, and solvents. Prevents rust, corrosion, abrasion, and protects against weathering. Application precedures, insulation values, and a chart for calculating amount of liquid needed to provide a specific thickness given. *Witco Chemical Co., Inc.*, 122 *E. 42nd St., New York* 17.

▸ *RECORDER CHARTS AND INKS*—28 page Catalog G-100-6 describes processes of making charts and inks for firm's recorders. Partial list of the most commonly used charts included. *Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia* 44.

▸ *RUST CONTROL*—two page Bulletin No. 16B describes procedures for preventing and removing rust. *Oakite Products, Inc.*, 151*B Rector St., New York* 6.



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Flexible Tubing is designed to help you in laying out both low- and high-velocity air conditioning systems.

It's extreme flexibility allows taking ducts around obstructions and through tight passages, in gradual, gentle bends with minimum air flow loss. Even when sharp bends are necessary, duct cross-section is held constant by the tubing's strong supporting wire helix — there's no air restriction!

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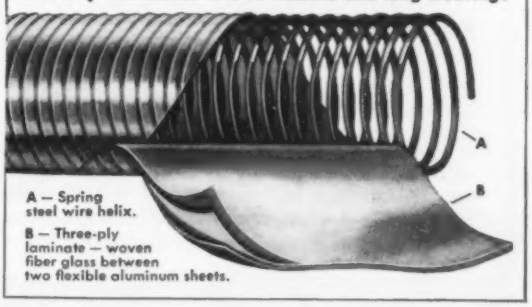

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RECENT TRADE LITERATURE

(Continued)

▸ *SEAMLESS WELDING FITTINGS*—and flanges in carbon, alloy, and stainless steel described in eight page booklet, FB-502A. Includes charts of standard sizes and schedules according to ASA B36.10 and ASA B36.19. Also contains breakdown of dimensional tolerances. *Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.*

▸ *SHUTOFF VALVES, GAS COCKS*—for operation in safety systems of plants using gas or fuel oil described in Supplemental Bulletin 22. Valves offered in nine sizes for ¾ to 6 in. pipe, with solenoid or pneumatic operators, reset wheels, and companion flanges. Gas cocks available in 14 sizes for ¼ to 6 in. pipe. *The North American Mfg. Co., 4455 E. 71st St., Cleveland* 5.

▸ *SIGHT GLASSES FOR PIPE LINES*—two page Specification Sheet No. DS-820 describes units with rotatable flanges. Information on construction materials, dimensions, and pressure ratings included. *Brooks Instrument Co., Inc., Hatfield, Pa.*

▸ *STEAM HEATING COILS*—24 page Catalog 1710 gives application data on blast heating coils, distribution tube heating coils, and dual feed distributing tube coils. Contains sections on construction details, selection, performance, piping diagrams, and installation procedures. Sizes and capacities also given. *Westinghouse Electric Corp., Sturtevant Div., Dept. T-448, Hyde Park, Mass.*

▸ *TEMPLATE*—for representing air mixing units in layouts of dual duct air conditioning systems. Made of a flexible, translucent plastic material, template has ¼ and ⅛ in. scales. Openings in both scales provided for air mixing units from 60 to 4000 cfm. *Buensod-Stacey, Inc., 45 W. 18th St., New York* 11.

▸ *THERMOCOUPLE SELECTOR SWITCHES*—described in a four page catalog. Information given regarding minimum space requirements for wall, bench, rack, or panel mounting. Data provided on construction, termination arrangements, internal wiring specifications, and cabinet designs. *Thermo Electric Co., Inc., Saddle Brook, N.J.*

▸ *TIMING BELT DRIVES*—80 page Catalog No. 19103 describes units for mechanical power transmission available for load capacities from fractional to 600 hp and for belt speeds up to 16,000 fpm. Charts provide selection data. *T. B. Wood's Sons Co.,* 1275 *Fifth Ave., Chambersburg, Pa.*

RECENT TRADE LITERATURE
Continued

▸ *UNIT HEATERS*—four page Bulletin DB4-101 describes firm's complete line of horizontal and vertical steam units. *Ilg Electric Ventilating Co., 2850 N. Pulaski Rd., Chicago 41.*

▸ *V-BELTS*—eight page Bulletin M-201 gives specifications and illustrated sections on the comparative advantages of straight sidewall construction in V-Belts. *Manhattan Rubber Div., Raybestos-Manhattan, Inc., Passaic, N. J.*

▸ *VALVE LUBRICATION*—eight page Bulletin No. V-128 Rev. 2 gives instructions for lubricating and servicing firm's valves. Also includes a chart of recommended lubricants and describes firm's lubricating equipment. *Rockwell Mfg. Co., Meter & Valve Div., 400 N. Lexington Ave., Pittsburgh 8.*

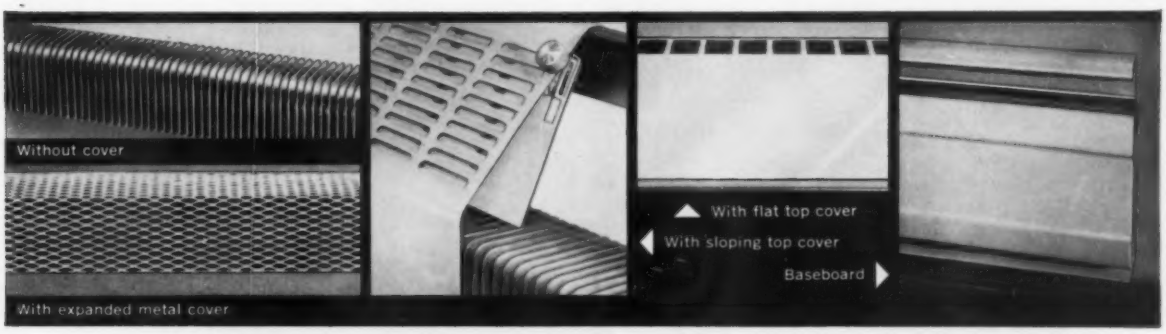
▸ *VALVES, FITTINGS*—12 page catalog describes firm's line of ductile iron units. Gives details on designs, weights, and dimensions, as well as comparison charts and engineering specifications. *Stockham Valves & Fittings, P. O. Box 2592, Birmingham 2, Ala.*

▸ *WARM AIR HEATING*—six page bulletin describes firm's oil and gas fired equipment. Heaters, burners, and heat exchangers discussed. Diagrams show special adaptations for some models. *Tjernlund Mfg. Co., 2140 Kasota Ave., St. Paul 8, Minn.*

▸ *WELDED STEEL TUBING*—available as fabricated or semi-fabricated items in five different steels described in four page folder, P.O. 6759. Tubing made from hot and cold-rolled steel, two grades of aluminized steel, and zincgrip steel, a hot-dip zinc-coated product. *Armco Steel Corp., Middletown, O.*

▸ *WELDER, POWER PLANTS*—two bulletins: Bulletin NH-182 describes diesel-engine welders with auxiliary a-c power. Rated output, 250 amp, 40 v; Bulletin NH-183 describes gasoline-engine units producing 300 amp, 30 v a-c, or 225 amp, 30 v d-c. Units and optional equipment illustrated. Specifications and dimensions given. *National Cylinder Gas Div., Chemetron Corp., 840 N. Michigan Ave., Chicago 11.*

▸ *WELDING TORCHES*—eight page Form 55-005 describes hand mixer type torch capable of welding any metal thickness from 28 gage sheet to heavy plate. Handles gas flows as low as 2 cu ft per hr and as high as 1500 cu ft per hr. Data on cutting attachments and welding heads included. *Linde Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17.*



32 different copper and steel heater elements to choose from in the complete SARCOfin line.

Choose the finned tube radiation that best meets your requirements—from the complete Sarcofin line. Choice of 32 different heating elements. Eight types of enclosures: flat-top, expanded metal, sloping top, modified flat top, sill-type and three baseboard cover types.

And for old or new homes, remember the variety, flexibility, and easy installation of Sarco-Pak baseboard radiation.

All ratings are approved under the I-B-R code. For your extra convenience, standard length "packages" are now available. Superb appearance matches high Sarco quality.

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PLANT: BETHLEHEM, PA.
STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

WE HEAR THAT...

▸ *EUTECTIC WELDING ALLOYS CORP.* will begin construction of a $2.5 million metallurgical plant and research center in 1962, to be built in Flushing, N.Y., firm headquarters.

▸ *JOHN J. NESBITT, INC.* has acquired the assets of Norman Products Co., manufacturers of gas-fired heating equipment.

▸ The new address of the Chicago sales office of the *AMERICAN NICKELOID CO.* is 6037 N. Cicero Ave.

▸ The *CRUCIBLE STEEL CO. OF AMERICA* has established an Australian company to offer its warehouse services.

▸ *AMERICAN-STANDARD CONTROLS DIV.* is the new name of the Detroit Controls Div. of American Radiator & Standard Sanitary Corp.

▸ *A. O. SMITH INTERNATIONAL S. A.* has begun construction of a 14,000 sq ft branch plant in Stratford, Canada. The plant will be used initially for the production of commercial water heaters.

▸ *DIAMOND EXPANSION BOLT CO., INC.* has opened a new branch warehouse in Richmond, Va. to serve the Washington, D.C., North Carolina, and Virginia areas.

▸ *CERRO CORP.* is the new name of Cerro de Pasco Corp. The change was made "in the belief that a more general name, rather than one of local origin" would better identify the firm's activities.

▸ *ROBERTSHAW-FULTON CONTROLS CO.* has formed a new subsidiary, *ROBERTSHAW ORIENT, LTD.*, to manufacture automatic controls in Japan.

▸ The stoker business formerly handled by *AMERICAN ENGINEERING CO.* has been transferred to the *DETROIT STOKER CO.* All patents, designs, and inventories included. Both firms are divisions of the *UNITED INDUSTRIAL CORP.*

▸ *CONTROLS CO. OF AMERICA* has organized *CONTROLS CO. OF AMERICA (U.K.) LTD.* to manufacture and sell heating and other controls in Great Britain.

The world-wide respect and demand for this original Miller gas engine driven welder/power plant has never been greater. To this established popularity has now been added the convenience of Bendix drive electric starting as optional equipment on models AEA-200-L and AEA-200. Model illustrated and headlined is AEA-200-LE.

As a welder, as a power plant, as a pipe thawer, indeed, as a top hand from Canadian uranium mines to Brazilian cattle ranches — and on highway construction jobs and repair ships between — the AEA-200-L stands quite alone as "the finest in the field." In addition to optional electric starter, road trailers and rubber tired running gear are also available.

Other Miller gas engine driven DC and AC-DC welder/power plants to 300 amperes at 100% duty cycle. Full particulars will be sent promptly upon request, or a demonstration can be arranged at your convenience.

miller Electric Manufacturing Company, Inc., APPLETON, WISCONSIN

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FIRST in the Industry with a New Concept and Configuration in Air Cooled Package Equipment

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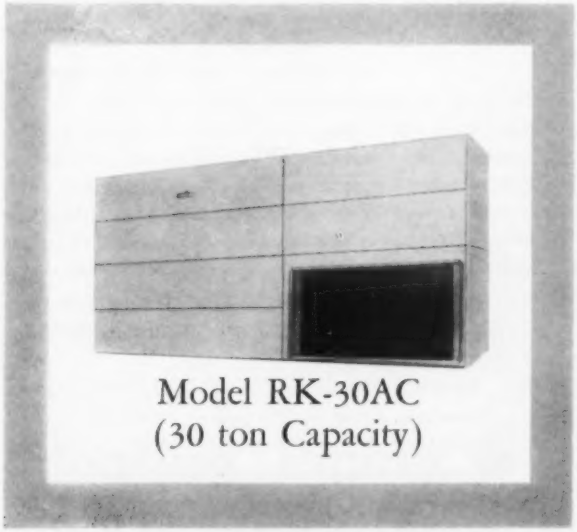
with completely new styled Air Cooled Condenser an integral part of the unit



Model RK-30AC
(30 ton Capacity)

Opens tremendous new opportunities in shopping center, factory, bowling lane, variety chain, restaurant, amusement places and many other commercial and industrial applications.

WRITE FOR BULLETIN 94A-1

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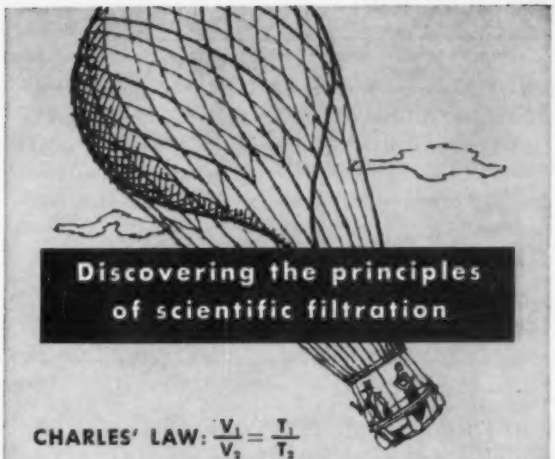
Delaware, Ohio



Discovering the principles of scientific filtration

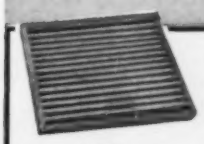
CHARLES' LAW: $\frac{V_1}{V_2} = \frac{T_1}{T_2}$

"Gases under constant pressure expand in equal proportion from the same temperature for equal temperature increments."
Jacques Charles (1746-1823)

Through his interest in ballooning, French physicist Jacques Charles, in 1787, determined that the pressure coefficients of expansion of all gases are the same. Further study by Guy-Lussac in 1802 revealed that all gases have the same volume coefficient of expansion; later Regnault observed that the increase in volume per degree centigrade was 1/273 of the original volume.

Similarly at Air-Maze, constant research and testing establishes new principles to improve filtration. For 35 years Air-Maze engineers have worked together pioneering new industrial filtration products based on the findings of Charles and others. The result is a complete line of specialized industrial filtration products for every situation involving the movement of gases and liquids.

Shown below are representative products developed by Air-Maze engineers to keep equipment clean and free from damaging contaminants for longer, better operation.



Only Air-Maze P-61 Permanent Dry Type panels combine extended area with water-washability. Result: lower resistance, greater dirt holding capacity.

Misti-Maze electronic oil mist and fume eliminator permits air recirculation, reducing heating or cooling load. Ideal for machining or welding operations. Includes motor and exhaust fan.

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WE HEAR THAT

Continued

▶ Fred S. Dubin and Harold L. Mindell of *FRED S. DUBIN ASSOCIATES, CONSULTING ENGINEERS,* recently visited the School of Design, North Carolina State College. The two were guest lecturers and conducted engineering critiques for fourth and fifth year students.

▶ *CRESCENT TOOL CO.* has been purchased and will be operated as a wholly owned division of a new corporation, *CRESCENT NIAGARA CORP.*

▶ *AUTHORIZED SUPPLY CORP.* has moved into new office and warehousing facilities at 1437 S. Los Angeles St., Los Angeles 15.

▶ *REVERE COPPER AND BRASS INC.* has formed a wholly-owned Panamanian company, *REVERE INTERNATIONAL, INC.*

▶ A new welding laboratory has been placed in operation at the *HUNTINGTON ALLOY PRODUCTS DIV., THE INTERNATIONAL NICKEL CO., INC.* The 4000 sq ft facility was completed last December and specialized equipment is now being installed.

▶ *AIR CONTROL PRODUCTS, INC.* has completed a new plant in Coopersville, Mich. which adds more than a third to the company's manufacturing capacity.

▶ A 24,000 sq ft facility in Southfield, Mich. is the home of *MAXITROL CO.'S* new general offices and research laboratory.

▶ *LAWSON MANUFACTURING CO.* has purchased the *EVERHOT HEATER CO.* from *TEMPRITE PRODUCTS CORP.* The firm will be operated as a division of Lawson, with a new branch and complete facilities at Detroit.

▶ *PENN CONTROLS, INC.* has formed a Japanese company to manufacture automatic controls in Japan. *SAGINOMIYA-PENN CONTROLS LTD.* is partially owned by a Japanese firm.

▶ a new $750,000 branch manufacturing plant is being built for *THE UNIVERSAL ELECTRIC CO.* in Ripley, Tenn. The 60 acre branch will go into operation in mid-February with full production by the end of March.

▶ *WHEELABRATOR CORP.* has formed a Canadian company, *WHEELABRATOR CORP. OF CANADA, LTD.*

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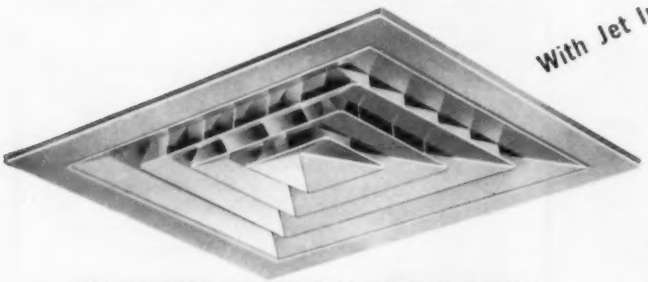

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- Solid construction eliminates strumming or vibration.
- A metal plate is welded at the corner joints to add greater rigidity to the unit.

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These AGITAIR diffusers with built-in diffusing vanes, are designed and positioned to serve as air pumps, compressing the air into a multiplicity of jets. These jets issuing from spaces between adjacent louvers, produce a high degree of turbulence which rapidly mixes the primary and room air and assures control of the entire cubicle contents of the spaces served.

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January 1959 "What to Consider When Selecting Valves", 16 pp ——

February 1959 "Air Pollution Control Demands Engineering Analysis, Design", 16 pp ——

May 1959 "Application of Cork Installation to Cold Pipe Lines", 20 pp ——

June 1959 "How to Control Particulate Emissions to Abate Air Pollution," 16 pp ——

October 1959 "Environmental Control Key to Success of the Manned Earth Satellite", 16 pp ——

November 1959 "High Intensity Infrared Radiant Heating", 16 pp ——

March 1960 "Evaporative Cooling — When and How to Use It", 16 pp ——

April 1960, "How to Select Multiple-Leaf Dampers for Proper Air Flow Control", 12 pp ——

July 1960 "What to Consider When Selecting Check Valves, Valve Operators, and Accessories", 12 pp ——

September 1960 "Air Force Engineers Hear Ways to Improve Heating System Operation and Maintenance", 16 pp ——

October 1960 "Preventive Maintenance Paves Way to Dependable Operation", 12 pp ——

November 1960 "What to Consider When Designing Nuclear Piping Systems", 16 pp ——

December 1960 "How to Design and Operate Flooded Evaporators For Cooling Air and Liquids", 16 pp ——

January 1961 "How To Apply High Intensity Infrared Heaters for Comfort Heating," 16 pp ——

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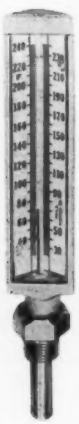

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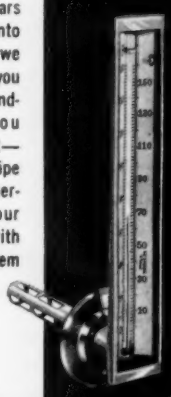

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MEETINGS & CONVENTIONS

FEB. 13-16 — *American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., semi-annual meeting.* Conrad Hilton Hotel, Chicago. Information: ASHRAE, 234 Fifth Ave., New York 1.

FEB. 13-16 — *International Heating and Air Conditioning Exposition.* International Amphitheater, Chicago. Information: E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17.

FEB. 15-17 — *The Aluminum Association, annual meeting.* Cleveland. Information: AA, 420 Lexington Ave., New York 17.

MARCH 13-17 — *17th Annual Conference and* 1961 *Corrosion Show.* Statler Hilton Hotel, Buffalo, N.Y. Information: National Association of Corrosion Engineers, 1061 M & M Building, Houston.

MARCH 27-31 — *Third National Symposium on Temperature — Its Measurement and Control in Science and Industry.* Sponsored by American Institute of Physics, Instrument Society of America, and National Bureau of Standards. Columbus, Ohio. Information: W. R. Tilley, National Bureau of Standards, Washington, D.C.

APRIL 10-21 — *American Welding Society's 42nd Annual Convention and Welding Exposition.* Convention at the Sheraton-Atlantic Hotel and the Show at the Coliseum, New York. Information: AWS Information Center, 33 W. 39th St., New York 18.

APRIL 23-27 — *Oil Heat Institute of America, 39th Annual Convention.* Statler-Hilton Hotel, Washington, D.C. Information, Francis J. Schuster, convention chairman, OHI, 500 Fifth Ave., New York 36.

JUNE 4-9 — *Seminar on Electrical Precipitation.* The Pennsylvania State University, University Park, Pa. Information: Conference Center, The Pennsylvania State U., University Park, Pa.

JUNE 12-15 — *National District Heating Association, 52nd Annual Meeting.* Wentworth-by-the-Sea, Portsmouth, N.H. Information: John F. Collins, Jr., secretary-treasurer. NDHA, 827 N. Euclid Ave., Pittsburgh 6.

MEETINGS & CONVENTIONS

Continued

JUNE 12 — *Air Pollution Instrumentation Symposium*, in conjunction with the *JUNE* 12-16 *Annual Meeting of the Air Pollution Control Association*. Sponsored by ISA and APCA, Hotel Commodore, New York. Information, APCA, 4400 Fifth Ave., Pittsburgh 13.

SEPT. 27-*Oct.* 4 — *The Institute of Heating and Ventilating Engineers, International Conference on Heating, Ventilating and Air Conditioning*. London, England. Information: F. L. Rossetti, secretary, Conference Coordination and Management Committee, 49, Cadogan Sq., London, S.W.1.

1962

FEB. 12-15 — *Air-Conditioning and Refrigeration Institute, 12th Exposition*. Pan-Pacific Auditorium, Los Angeles. Information: George E. Mills, ARI Show Director, ARI, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NEW BOOKS & REPORTS...

Soil Temperature Variation (1952-1956) *At Lexington, Kentucky* — A report on the geophysical studies at the University of Kentucky to derive an equation to aid in calculating soil temperatures at various depths at any given time. Report prepared by E. B. Penrod, J. M. Elliott, and W. K. Brown, University of Kentucky, Lexington, Ky.

AD 1-1960 *Adsorption Equipment* — Covers the following for pressure ranges of 0 to 10 and 10 to 500 psig: determination of moisture vapor dew point; procedure for testing solid adsorption-type desiccant dryers; and definitions. National Electrical Manufacturers Association, 155 E. 44th St., New York 17. Price, 60 cents.

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AWS Standard Welding Terms and Their Definitions — A new revision of the American Welding Society's dictionary of welding. Includes a master desk chart of 39 welding processes. Chart also available in a 22 × 28 in. size for wall use. AWS, Dept. T., 33 W. 39th St., New York 18. Prices: booklet with desk chart, $2.00; desk chart alone, $.50; wall chart, $1.50.

Commercial Standard CS230-60, Vinyl Plastic Weatherstrip — Establishes three grades of vinyl plastic weatherstrip according to hardness values. Gives physical properties, test methods for determining hardness, tensile strength, and other characteristics for each grade. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price, 10 cents.

Pressure-Temperature Ratings of Plain End Pipe Used in Power Plant Piping Systems — Contains pressure-temperature ratings of carbon steel and low alloy steel pipe commonly used in power plant piping systems within the scope of Section 1 of the Code for Pressure Piping, ASA B31.1 — 1955, and Section 1 on Power Boilers of 1959 ASME Boiler and Pressure Vessel Code. Prepared by the Engineering Standards Committee, The Pipe Fabrication Institute, Suite 759, One Gateway Center, Pittsburgh 22. Price, $2.00.

Atmospheric Emissions from Petroleum Refineries, Public Health Service Publication No. 763 — Supplements the Los Angeles County "Joint Project" reports on refinery emissions and stresses the use which can be made of the methodology and results of this group in estimating these emissions. Includes a discussion of equipment and processes, details on the sources, magnitude of emissions, and methods of control in effect in Los Angeles County refineries. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price, 30 cents.

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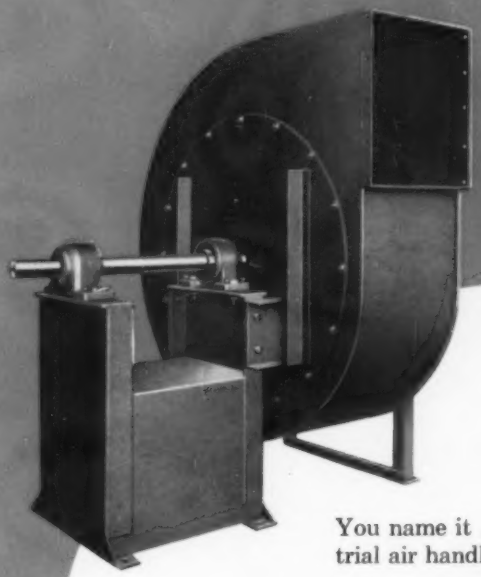

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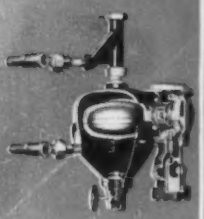

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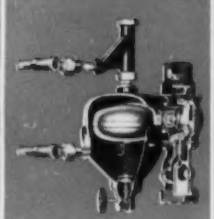

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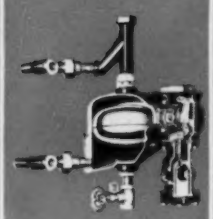

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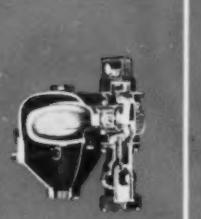

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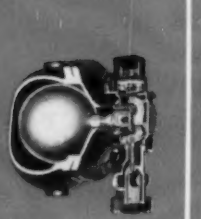

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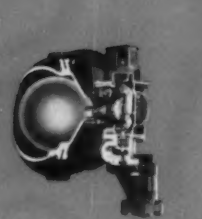
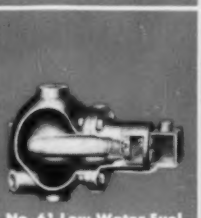


No. 53-2 Feeder Cut-off Combination — Like No. 51-2 but for higher pressures up to 75 lbs.

No. 67 Low Water Fuel Cut-off for low pressure automatically-fired steam boilers.

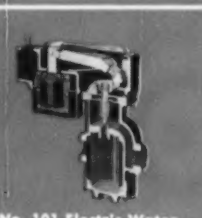
No. 63 Low Water Fuel Cut-off for hot water space heating boilers up to 50 lbs. pressure.

No. 69 "Built-in" Low Water Cut-off. One of many "built-ins" for installation in tapping provided in modern boilers.



No. 61 Low Water Fuel Cut-off for 1" equalizing pipe installation on low pressure steam boilers.

No. 767 Low Water Fuel Cut-off (with No. 14 blow-off) for installation in boiler opening.



No. 101 Electric Water Feeder — Operated by McDonnell two-switch cut-offs or liquid level switches.

How many of these McDONNELL products do you know?

Check them over. You'll find a number of products you know well—but you'll also find many to solve those special problems that come up calling for liquid level controls, flow switches, and related equipment. It will pay you to know these and other products in the McDonnell FULL LINE. Ask for complete information.

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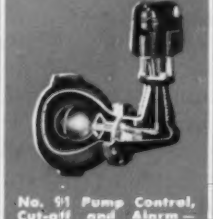
Your Jobber Stocks McDONNELL Products

No. 150 Pump Control, Cut-off and Alarm Switch for boilers of any size up to 150 lbs. pressure.

No. 157 Pump Control, Cut-off and Alarm — Like No. 150 but with integral water column.



No. 91 Pump Control, Cut-off and Alarm — New magnetic repulsion switching type for boilers of any size up to 150 lbs. pressure.

No. 191 Pump Control, Cut-off and Alarm — Like No. 91 but with integral water column.

No. 92 Pump Control, Cut-off and Alarm — new magnetic repulsion switching type for pressures up to 250 lbs.

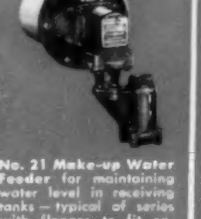
No. 192 Pump Control, Cut-off and Alarm — Like No. 92 but with integral water column.

No. 355 Large Capacity Float Valve—many uses on tanks, stills, receivers, etc.

No. 4155 Feed Water Controller for multiple boiler jobs to divert pump discharge into proper boiler.

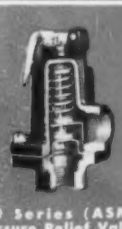
No. 65 Explosion-proof Electric Controller Underwriters' listed for hazardous locations.

No. 80 Float Switch. Three-wire high- or low-level alarm (or pump control) on oil storage tanks.



No. 21 Make-up Water Feeder for maintaining water level in receiving tanks — typical of series with flanges to fit existing tank openings.

No. 27TA Make-up Water Feeder for external application on receiving tanks.



230 Series (ASME) Pressure Relief Valves for hot water boilers, tanks and heaters.

240 Series (ASME) Pressure Relief Valves for larger hot water boilers, tanks and heaters.

No. 201 Temperature Relief Valve for hot water tanks and heaters. A.G.A. tested, rated and listed.

202 Series Automatic Reseating Pressure and Temperature Relief Valves. ASME (NB) A.G.A.

FS4 Series Flow Switch completes (or breaks) circuit when flow starts or stops. Max. psi, 100 lbs. Underwriters' Listed.

E-2 Series Flow Switch for higher pressure service; max. psi, 150 lbs. Completely waterproof construction.